The 10th International Conference on Virtual Learning
VIRTUAL LEARNING – VIRTUAL REALITY

Phase II - Period 2010-2020: e-Skills for the 21st Century
www.icvl.eu | www.cniv.ro
The ICV and CNIV projects supports Digital Agenda-Europe 2020

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ICVL 2015 dedicated professors Leon LIVOVSCHI (1921-2012)

and

Octavian BÂSCĂ (1947-2003), Romanian informatics pioneers

ICVL and CNIV Coordinator: Dr. Marin Vlada, University of Bucharest

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Proceedings of the 10th International Conference on Virtual Learning

OCTOBER 31, 2015

MODELS & METHODOLOGIES, TECHNOLOGIES, SOFTWARE SOLUTIONS
Phase II - Period 2010-2020: e-Skills for the 21st Century

editura universității din bucurești, 2015

ICVL and CNIV Partners: Grigore Albeanu, Mircea Popovici, Radu Jugureanu, Adrian Adăscăliței, Olimpius Istrate

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MOTTO

„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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About ICVL 2015

ICVL Project – www.icvl.eu

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

C^{3}VIP: "Consistency-Competence-Clarity-Vision-Innovation-Performance"

© Project Coordinator: Ph.D. Marin Vlada, University of Bucharest, Romania
Partners: Ph. D. Prof. Grigore Albeanu, Ph. D. Mircea Dorin Popovici,
Prof. Radu Jugureanu, Ph. D. Adrian Adăscăliței, Ph D. Olimpius Istrate

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

October 31, 2015 – TIMISOARA, ROMANIA

Location: West University of Timisoara, Faculty of Mathematics and Computer Science, ROMANIA

Organizers: University of Bucharest, West University of Timisoara

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.

Conference Organisation

- General Chair **Dr. Marin Vlada**, Professor of Computer Science, University of Bucharest, Research Center for Computer Science (Romania), European INTUITION Consortium member

- Technical Programme Chair **Dr. Grigore Albeanu**, Professor of Computer Science, Spiru Haret University, Research Center for Mathematics and Informatics (Romania)

- Associate General Chair **Dr. Dorin Mircea Popovici**, Professor of Computer Science, Ovidius University of Constanta (Romania), CERV- European Center for Virtual Reality (France)

- Associate General Chair **Prof. Radu Jugureanu**, AeL eContent Department Manager, SIVECO Romania SA, Bucharest, Romania

- Associate General Chair **Dr. Adrian Adăscăliței**, Technical University "Gh. Asachi" of Iasi, Romania

- Associate General Chair **Dr. Olimpius Istrate**, University of Bucharest, Faculty of Psychology and Educational Sciences, Romania

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Dr. Mihaela Oprea	Professor in the Department of Informatics, University of Ploiesti, Romania
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Dr. Marin Vlada	Professor of Computer Science, University of Bucharest, Romania, *European INTUITION Consortium member*

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**

ICVL Project, 10 years.
The impact of new technologies in education and research

Marin Vlada[1], Grigore Albeanu[2], Adrian Adăscăliței[3]

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Abstract

The article describes the educational and research projects at the University of Bucharest which are two scientific traditions in the fields of e-Learning and educational software and supporting programs FP7, Horizon 2020 and the European Digital Agenda. The following steps are defined achievement: Phase I – Period 2000-2010: Research, Education and Training - Virtual Learning, Virtual Reality; Phase II - Period 2010-2020: e-Skills for the 21st Century | Virtual Environments for Education and Training; Phase III – Period 2020-2030: Intelligence Learning, Knowledge Society and Learning Culture. If in areas like physics, chemistry, etc., many scientific findings are based on scientific experiments, behold, by the aid of computer methods can be powerful and effective tools for testing and demonstrations. For example, I can give the solutions to the following problems: the four colours (1977), combinatorial problem that underlies the backtracking method (method of artificial intelligence); smart chess program (historic defeat of Russian champion Garry Kasparov in front of Deep Blue in May 1997 in New York) defeating the man; the completion code sequences for the human genome, DNA (2005). Obviously there are many situations in mathematics when not in use computer.

Keywords: Education, Educational Software, Software Systems, Technologies

1 Introduction

Motto:
"*Almost all trades that someone will practice in the future, from engineering to musicology, from atomic physics to tourism, from history to medicine, will use the computers. Computers do not go alone to go must have skilled people to incense. To have skilled people, we need to learn: WHAT*?
Grigore C. Moisil (1906-1973), we'll see - Science and humanism in the "Contemporanul" (The journal "Contemporary"), no. 15 (1378), April 6, 1973.

The computer and the software products are modalities and instruments for forming a new vision on education, research and innovation.

The learning process require the use of appropriate, timely and effective to lead to understanding of concepts, phenomena, processes, methods of solving problems specific to a discipline of knowledge. Today, and teachers, and students are increasingly challenged by the great changes of the past 20 years that not only knowledge in general, but especially the impact of new technologies is achieved using new approaches to solving problems, new methods in training, new activities and research tools. Today in 2015, we can conclude that the term "virtual learning/education" is not replacing traditional education forms and ways to eliminate the role of teachers in the teaching process, but on the contrary should represent forms and modern ways to achieve a higher level the teaching-learning-assessment through ICT.

The computer and new technologies (equipment, technology and software) provides training modalities and instruments of a new vision of education, research and innovation.

For young people today, but for the other generations, immediately after 2000, the University of Bucharest (The e-Learning ICVL and CNIV Projects) has released the lead in developing resources to promote, explain and synthesize the emergence of new technologies in education and research and evolution, development and their impact on human society [1, 2].

It was intended use COMPUTER-EDUCATION-RESEARCH triad and promoted best practices in teaching and learning through new disciplines teaching-learning supported by new technologies offered by the use of computers in the learning process.

Research, development and innovation in Computer Science and Information and Communication Technology (ITC) fared especially after 1971, when he invented the "jewel" 20th century, the microprocessor as a result of successes in three top: cyber systems, integrated circuits, micro-programming.

These educational and research projects give an opportunity to the various actors involved in the education system, to express opinions and studies on the efficiency and performance of the education system, including the use of digital textbooks in the educational process.

Computer and information technologies have changed and were completed by the evolution and development of theories, methods, techniques and technological tools (systems, software, applications, etc.), all used in various fields of human problem solving, once with increased efficiency and performance in the organization of human activities.

2 Objectives of the initiative

Educational and research project at the University of Bucharest, founded in 2003 as a result of challenges from the early 2000s, the information society technologies (ICT), has proposed the following strategic objectives (CNIV National Project founded in 2003, ICVL International Project founded in 2006):

- Goal - Implement the Information Society Technologies (IST / FP6 / FP7 / Horizon 2020, Europe Digital Agenda) to the EU requirements; It aims to promote and implement modern ideas in initial education and training, promoting the spirit of work / research teams, attracting and inclusion of young people in the research and development, promotion and implementation of technologies like ICT in education and training; addresses the authors of e-learning products and educational software, specialists, teachers, researchers, students and professors interested in the field of educational technologies supported models, methodologies and software solutions.
- Specific objectives - Develop research projects and applications in the areas of E-Learning, Software and Educational Management (Models and Methodologies, Technologies, Software Solutions); It aims to provide a vision of European e-Learning and e-Training policies and to take stock of the situation existing today as well as to work towards developing a forward looking approach. Participation is invited from researchers, teachers, trainers, educational authorities, learners, practitioners, employers, trade unions, and private sector actors and IT industry; The success of these scientific meetings is that desired and collaboration between academics, labour market and education to support the development of rural education in Romania.

ICVL Project is a fast moving, ICVL Conference that focuses on revolutionizing the way science is taught to students all over the world. Our initiative offers a “Virtual Laboratory” provided as a supportive curriculum based e-tool where students and researchers can work with real-life challenges in an online environment that simulates reality. Also, it provides important support for research using new technologies.

ICVL Project intends to explore and propose innovations in education in the perspective of the Knowledge Society.

The International Conference on Virtual Learning has the following objectives:

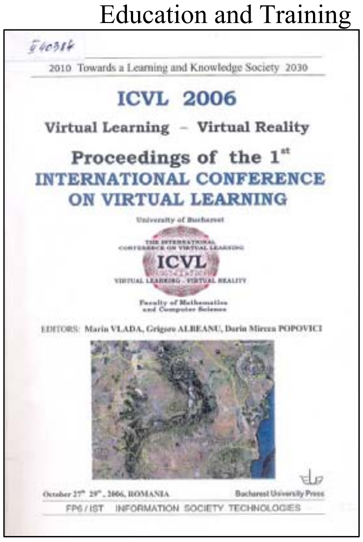
- creating a framework for a large scale introduction of the eLearning approaches in teaching and training activities;
- assisting the teachers, professors and trainers in the use of innovative teaching technologies both in formal education and life-long learning;
- stimulating the development of eLearning projects and software for education process and systems;
- promoting and developing scientific research for e-Learning, Educational Software and Virtual Reality.

Today, CNIV and ICVL are scientific events promoting innovative technologies and methodologies in education, research and lifelong improvement, both in the pre-university and university milieu, and in the economic sector, too. Structured and organized by European principles and International standards, the two projects promote implementation of modern ideas in the initial education and continuous training, encourage and promote teamwork and collaborative activities, scientific methods and experiments, creative thinking and intuition, arguing, and proving.

Figure 1. **ISE News – Inspiring Science Education, ICVL Project**

They defined the following stages of development:

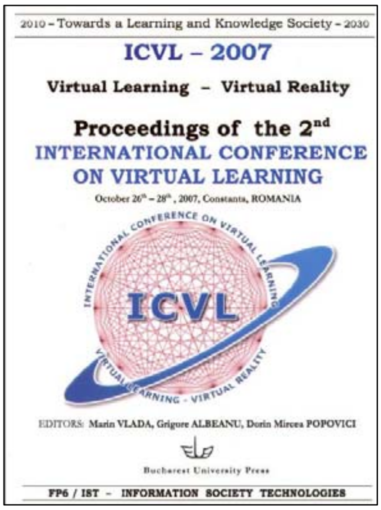
- *Phase I* - Period 2000-2010: Research, Education and Training - Virtual Learning, Virtual Reality
- *Phase II* - Period 2010-2020: e-Skills for the 21st Century, Virtual Environments for Education and Training



- *Phase III* - Period 2020-2030: Intelligence Learning, Knowledge Society and Learning Culture

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 Modelling
- 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 Ontology
- 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

2 Activities and Results

The accepted papers will be included in the conference proceedings only if are prepared according to the guidelines provided on the Conference website. Manuscripts will be reviewed in accordance with the standard practice and criteria by Technical Programmed Committee. All submissions will be reviewed on the basis of relevance, originality, significance, soundness and clarity. At least two referees will review each paper proposal submission under a double peer-review process [1].

The papers will be published in Conference Proceedings as well as on a CD/online. Your paper should have a maximum length of 8 pages and be prepared according to the instructions provided. Manuscripts should be submitted in Microsoft Word or RTF file formats. All papers must be typed in Microsoft Word using Times New Roman and at 11-point font [1].

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Sections and Thematic Areas
MODELS & METHODOLOGIES (M&M):

- Innovative Teaching and Learning Technologies
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- Educational Technology, Web-Lecturing Technology
- Mobile E-Learning, Communication Technology Applications
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- Intelligent Virtual Environment

SOFTWARE SOLUTIONS (SOFT):

- New software environments for education & training
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- Software Computing in Virtual Reality and Artificial Intelligence
- Avatars and Intelligent Agents

"Intel® Education" - Innovation in education and research (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

In the 10 editions of the conference were sent abstracts and papers author from all continents, namely from the following countries: *Romania, USA*, *France, United Kingdom*, *Italy, Belgium, Spain, Portugal, Denmark, Finland, Sweden, Greece, Turkey, Iran, Russia, Kazakhstan, Bulgaria, Republic of Moldova, Hungary, Slovakia, Serbia, Russia, Kazakhstan, Japan, China, Korea, India, Mexico, Nigeria, Morocco, Brazil, South Africa, New Zealand*.

Annually, an average of 108 proposals were received, 85 accepted abstracts and finally 58 papers accepted for publication.

Table 1. Proposals received, Accepted abstract, **Published papers (2006-2015)**

Edition number	1	2	3	4	5	6	7	8	9	10
Proposals received	55	45	64	103	134	145	146	104	155	121
Accepted abstract	55	45	62	89	111	124	110	68	97	81
Published papers	34	35	44	52	78	85	67	55	70	69

In addition, the conference theme is the importance and diversity of participants, namely highly interdisciplinary approaches in research methods, studies and results. Below, is average number of participant's adequate scientific or professional titles.

Table 2. **Participants – Scientific / professional title**

Sc./Prof. Title	Professor	Researches PhD	PhD candidate	M.Sc.	Teachers	Project Manager	Specialist/ Trainers
Average Number	90	14	12	10	8	7	7

Order Number	ICVL edition	ICVL Location	Received papers	Published papers	Awarded papers
1	2006	Bucharest	55	34	--
2	2007	Constantza	45	35	2
3	2008	Constantza	64	44	2
4	2009	Iasi	103	52	2
5	2010	Targu-Mures	134	78	2
6	2011	Cluj-Napoca	145	85	4
7	2012	Brasov	146	67	3
8	2013	Bucharest	104	55	--
9	2014	Bucharest	155	70	--
10	2015	Timisoara	121	60	--

Figure 2. **Evolution of the number of papers published at ICVL (2006-2015)**

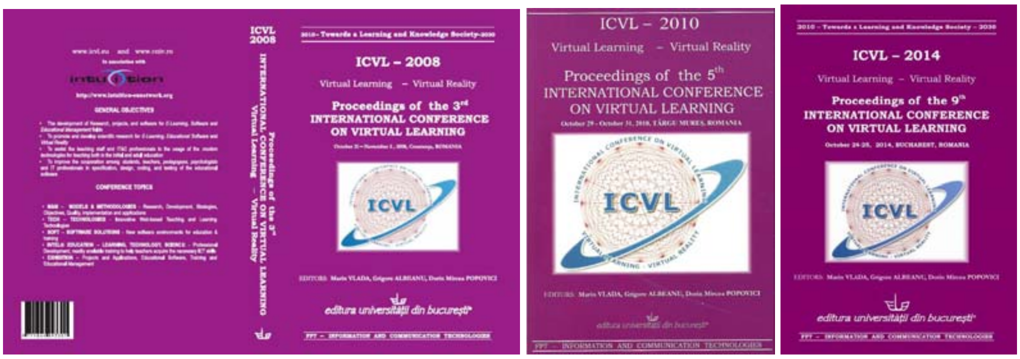

Figure 3. **Proceedings of ICVL, ed. 2008 and 2014**

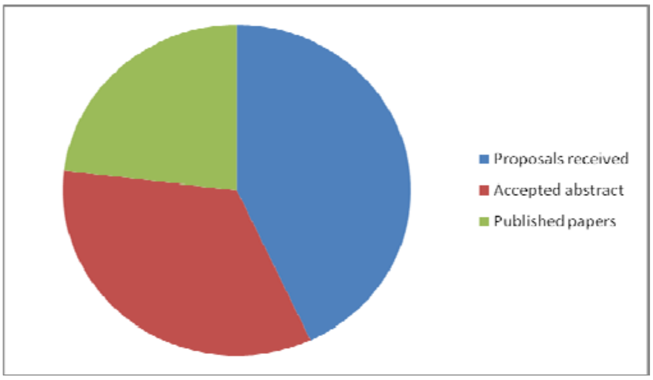

Figure 4. **Graph, Evolution of ICVL papers**

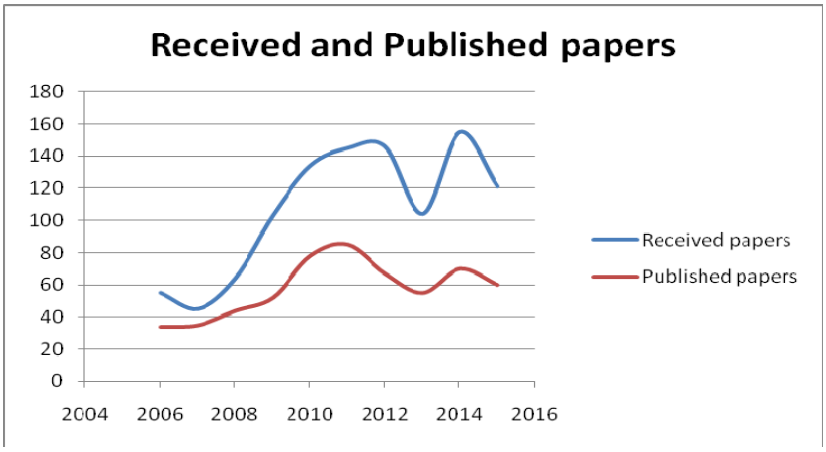

Figure 5. **ICVL papers - The graph of evolution**

3 Events and educational projects in Romania

Events and educational projects inspired / adjacent CNIV (*National Conference on Virtual Learning*) project "New Technologies in Education and Research":

1. **2005 year - eLSE**: *The International Scientific Conference* "*eLearning and Software for Education*" National Defence University "Carol I" (Web: http://www.elseconference.eu). ELSE Conference "eLearning and Software for Education" is organized annually (April) by the "Romanian Advanced Distributed Learning" and the National Defence University "Carol I".
2. **2006 year- ICVL**: *The International Conference on Virtual Learning*, University of Bucharest (Web: http://c3.icvl.eu/) ICVL Conference "2010 - Towards the Learning and Knowledge Society – 2030" is organized annually (October) of the University of Bucharest in partnership with the most prestigious universities in Romania.
3. **2007 year - Smart Kids**: *International Symposium "Education and new technologies in the Euroregion"* Timisoara (Web: http://www.smart-kids.ro). The event is held annually (December) ISJ Timisoara at the National College "C.D. Loga" Timisoara and includes Scientific Session "Education and new technologies in the Euroregion".

4. **2009 year -** POSDRU *European project "creator Professor"* MEC (Web: http://www.profesorulcreator.ro). The overall objective of the project (2009-2012) is developing and implementing a training program for teachers in pre-university education.

5. **2010 year -** POSDRU *European project "Multi Touch"* MEC (Web: http://transdisciplinar.pmu.ro/resurse). The "educational process optimized vision skills knowledge society" (2010-2012) of continuous training for teachers in pre-university education, a unique project in Romania that uses revolutionary technology and learning in transdisciplinary context.

6. **2010 year -** *MoodleMoot Romania, Moodle Romania* (Web: https://www.moodle.ro, https://www.moodle.ro/preparandia). MoodleMoot Romania is meeting platform users of e-Learning Moodle and addresses to the pre-academic and public institutions (themes: e-Learning, e-Pedagogy, e-training, e-Skills, Moodle in pre-university - projects and examples; Moodle university education - projects and examples; Moodle training tool).

7. **2011 year -** *Edu Vision, Agora Media* (Web: https://www.eduvision.ro). EduVision Conference represents an important platform for discussion of examples of good practice, trends, innovations and innovations in the field of eLearning.

8. **2013 year -** *Designing and developing digital textbooks, MEC, CNIV Romania*, educational organizations (Web: http://c3.cniv.ro/?q=2013/digital, http://c3.cniv.ro/?q=2014/digi2014, https://www.manuale.edu.ro, http://www.manualedigitaleart.ro). The concept of the digital textbooks is the result of permanent concerns of the various stakeholders of the educational process for the use of ICT in education after 2000, when the research and pioneering activities were carried collaboration between teachers, specialists in education sciences and IT specialists from various IT companies, to promote and develop new technologies in education: e-Learning, educational Software, Virtual Reality and Augmented Reality.

9. **2013 year -** *The contest "Teaching Nova" University of Bucharest, Romania CNIV* (Web: http://www.unibuc.ro/d-nova/, http://c3.cniv.ro/?q=2014/digi2014). Teachers have the responsibility "to improve teaching, always keeping in mind the assessment of learning outcomes, student autonomy, ability of critical thinking, problem solving, teamwork, and integration into an organization after graduation." (Art. 40. University Charter University of Bucharest).

10. **2014 year -** *The university qualifications: Developed e-Learning and instructional* designer / instructional designer, MEN, NVIC Romania, educational organizations (Web: http://c3.cniv.ro/?q=2015/rncis, http://www.rncis.ro , http://c3.cniv.ro/?q=2014/digi2014). Universities of Romania are prepared to meets the requirements of European and the world, to provide university study programs in the digital age - 'Just Google It' Age?

11. **2015 year -** *"Moodle in Education"* ISJ Neamt, High Technology "Vasile Sav" Roman (Web: https://vasilesav.moodle.ro/mod/page/view.php?id=591). National Conference "Moodle in Education" (Teachers educational software programs, blended-learning and Moodle) is organized by High Technology "V. Vas "Teachers' House Neamt School Inspectorate and the Germans, with the main objective to promote examples of good practice in teaching e-learning technologies and software for educational purposes in schools affiliated EDU Network MOODLE Romania.

Conclusions

ICVL and CNIV projects at the University of Bucharest virtual learning has demonstrated how innovation in education and research. This was validated in the context of engagement and collaboration between academia, undergraduate and IT environment. The educational project and research at the University of Bucharest, founded in 2003 as a result of challenges from the early 2000s, the information society technologies (ICT), has proposed the following objectives: general objective - Implementation of information society technologies (IST / FP6 / FP7 / Horizon 2020) to the European Union requirements; Specific objectives - Develop research projects and applications in the areas of E-Learning, Software and Educational Management (Models and methodologies, Technologies, Software solutions).

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Romanian Informatics Pioneers, Leon Livovschi and Octavian Bâscă at the University of Bucharest

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Abstract

Livovschi Leon (1921-2012) and Octavian C. Bâscă (1947-2003) were professors of informatics at Faculty of Mathematics and Computer Science from the University of Bucharest, Romania. They were among the most popular professors of computer science at the Faculty of Mathematics, and therefore deserve gratitude and admiration for all their work and for their efforts in particularly contributing to the development of a new field like computer science, for many computer generation. The advent of the computer and theories that contributed to inventing, designing and building modern computer can not be compared with other invention in human history.

Keywords: Informatics, Computer Science, Software Systems, Technologies

1 Introduction

Motto: "*The collection of people, hardware, and software – the multi-access computer together with its local community of users – will become a node in a geographically distributed computer network. Let us assume for a moment that such a network has been formed*."
J. C. R. Licklider, Robert Taylor, The Computer as a Communication Device, 1968.

"*What a teacher can give can not be found anywhere else. The rest are technicalities which you can find in the textbooks*" Dr. Prof. Dan Cristea stated at a meeting in 2008 with graduates from the Faculty of Informatics in Iasi.

It is our duty to those whom we were students, we should honor the contribution and sacrifices and explain to them that we were formed and sometimes they showed us the paths to understanding "foundations" future knowledge. The image below was performed at a promotional meeting for 10 years, 1978 - Informatics (October 29, 1988, Spiru Haret Auditorium, Faculty of Mathematics in Bucharest, where professors and alumni attended , including Professor Leon Livovschi (second from left) [12].

Intalnirea de 10 ani - 29 - 30 octombrie 1988

Vlada / prof.Livovschi / Butnareanu / prof.Vaduva / prof.Cazacu / prof.Dumitrescu / prof.Cuculescu

2 About Mathematics and Informatics appearance

If *Mathematics* had not existed, "*nothing would have existed*", neither zero (Digits 0-9 were invented by Indians, not by the Arabs) nor Physics, Chemistry or Architecture would have existed, no wheel and no Computer, no Printing and no Phone, no Informatics or Cybernetics. But to all these material entities invented by man, mathematics helps man think about life, create and imagine, love nature and his fellows to be emotional and courageous, be consistent and orderly to dream and be happy (*ICVL Project - News Technologies in Education and Research*).

Informatics/Computer Science has become a science because it uses methods, techniques and tools to investigate their objects and processes that define and operate. Scientific Treasure of Informatics is the result of symbiosis of knowledge and research and other sciences from (mathematics, cybernetics, microelectronics, physics, chemistry, etc.) and other methods and techniques, and the use of special devices (computer systems-computers) process information and knowledge which must interpret them, transform them and communicate them to others.

Computer Science and *Informatics* were considered identical terms. Today, the terms are different. The general public sometimes confuses Computer Science with Informatics or Information Technology (IT). Computing (information and knowledge processing) has changed the world and continues to influence nearly every aspect of our lives, including medicine and health care, business and finance, education and training, science and technology, politics and government, and entertainment.

We must mention that Informatics (Computer Science ≠ Informatics ≠ IT) is the result of contributions in science and technology, but no science can claim the invention of the computer, and none can be the invention of only one man.

"*Informatics studies the application of information technology to practically any field, while considering its impact on individuals, organizations, and society. It uses computation as a universal tool to solve problems in other fields, to communicate, and to express ideas.*" Judith Tolliver, Illinois Informatics Institute, University of Illinois - https://www.informatics.illinois.edu/.

"*Informatics has evolved as an independent science that links the Mathematics and Computer Science, covering a spectrum that goes from theory building models using mathematical tools, to implementing powerful and secure computing solutions*." Informatica Universitaria, Romania, www.informatica-universitaria.ro/ .

In the period 1945-1970, worldwide, it was the right time when the development of science and technology made possible both the emergence of electronic devices and equipment (microelectronics appearance, the storage and processing devices, etc.) – the hardware (engineering, IT) and the emergence of inventing programming languages, operating systems – software component (algorithms, computability, representation and processing, etc.).

Leon Livovschi

A young engineer, **Leon Livovski**, then became a professor at the University of Bucharest, and he pointed to articles in Soviet "Electricestvo" on the use of mathematical logic classic study of circuit switching. Thus, acad. *Grigore C. Moisil* (1906-1973) perused around 1950, soviet research (especially his V.I Shestakov and M.A. Gavrilov) on applications of mathematical logic in the techniques. Simultaneously, Claude Shannon published in the USA, some similar research undertaken similarly with the Soviet around 1938 acad. *Solomon Marcus* stated.

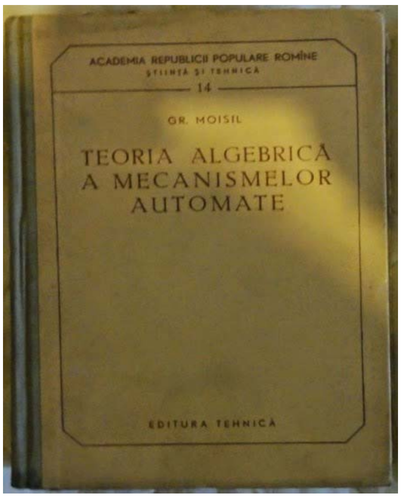
Octavian C. Bâscă, on the other hand, was a remarkable undergraduate of the Informatics School founded by *Grigore C. Moisil* at Faculty of Mathematics – Bucharest, who took over from this "relay race" and the most important issues on the development of informatics and computer use in the development of Romanian society. Today, new information technologies reached Informatics and IT, scientific and educational efforts of these pioneers to be an example for new generations, and to be known to those interested in the development of science.

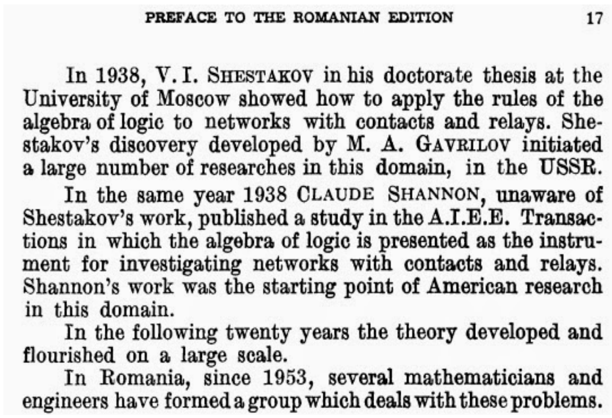
3 Leon Livovschi's collaboration with Grigore C. Moisil

Livovschi Leon was born on 26 May 1921 in the village Vărzărești, Lăpuşna district, today the Repubic of Moldova. In 1945 he graduated in Electromechanics (Aviation specialization) at the Polytechnic School in Bucharest, and in 1962 he graduated from the Faculty of Physics and Mathematics at the University of Bucharest. A doctor who won two titles, one in 1962 with the thesis "Synthesis of mechanisms mechanisms automatic pneumatic and hydraulic applications" and another in 1970 with the thesis "Relay contact circuits". He taught at the Institute of Oil -Gas and Geology (IPGG) and the University of Bucharest courses Theoretical Mechanics, Theory of Elasticity, Special Mathematics, Fundamentals of Informatics, Computer Programming, Formal Languages and Automata, Theory Algorithms, etc. He received awards from the Education Ministry in 1956, 1960 and 1968. He published alone or in collaboration, a total of 17 monographs and textbooks published by the Academy Publishing, Technical Publishing, Albatros Publishing, Scientific and Pedagogic Publishing, Scientific and Encyclopedic Publishing House and others. He published various articles in Informatics magazines for promotion Informatics among youth.

He also supported informatics competitions involvement of pupils and students nationally and internationally. For example, I had the opportunity to attend - the jury competitions, along with *Leon Livovschi* in 1993, the first edition of the Balkan Olympiad Informatics (BOI, Constanta), and in 1994, the first Olympiad in Informatics European Countries Central and Eastern Europe (CEOI, Cluj-Napoca). **Romania** is the initiator of *Balkan Olympiad in Informatics* (BOI) (1993, Constanta) and *Central-European Olympiad in Informatics* (CEOI) (1994, Cluj-Napoca). Also **Romania** is the initiator of the International Mathematical Olympiad (IMO) (1959, Brasov) - www.imo-official.org. We specify that **Bulgaria** is the initiator of the International Olympiad in Informatics (IOI) (1989, Pravetz) - http://ioinformatics.org/index.shtml. Since 1970 when he established the department of Computer Science / Informatics (*Informatics specialization*) at the Faculty of Mathematics, University of Bucharest, Leon Livovschi participated in the formation of many generations of experts from Romania, until 1986, when he retired.

To honor those who help us training!




PREFACE TO THE ROMANIAN EDITION 17

In 1938, V. I. SHESTAKOV in his doctorate thesis at the University of Moscow showed how to apply the rules of the algebra of logic to networks with contacts and relays. Shestakov's discovery developed by M. A. GAVRILOV initiated a large number of researches in this domain, in the USSR.

In the same year 1938 CLAUDE SHANNON, unaware of Shestakov's work, published a study in the A.I.E.E. Transactions in which the algebra of logic is presented as the instrument for investigating networks with contacts and relays. Shannon's work was the starting point of American research in this domain.

In the following twenty years the theory developed and flourished on a large scale.

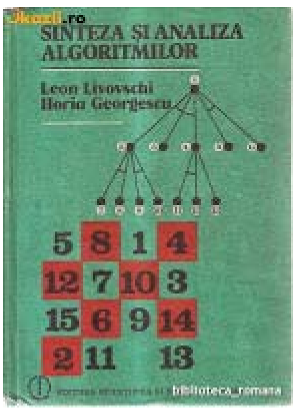
In Romania, since 1953, several mathematicians and engineers have formed a group which deals with these problems.

Recently I found information about professor Leon Lovovschi, to whom I was a student, in his book Grigore Moisil (1906-1973) "*The algebraic Theory of Switching Circuits*" (pdf) published in English (First English edition 1969, Library of Congress Catalog Card No. 63 – 10024, Pergamon Press, 719 pages), after Romanian language edition of "*Algebraic theory of automatic mechanisms*", Technical Publishing, 1959 from the French book "*Théorie structurelle des automates finis*" (Gauthier-Villars Paris, 1967-337 pages). In Preface to the English edition "*The author thanks all collaborators, mathematicians as well as engineers, for their contributions to this seminar, the result of which led to settling quite a number of problems in the theoty of switching circuits*." The text of the preface to the Romanian edition of 1959 (p. 17) (see image above) are referred to research Soviet thesis (made by *V.I. Shestakov* (1907 – 1987) and *M.A. Gavrilov*, Universiy of Moscow) on applications of mathematical logic in the technology, and the USA, *Claude Shannon's* created and published, as the Soviets did in 1938 year.

"*L. Livovschi (1921 – 2012) initiated with Moisil the use of finite automata to the design of electronic circuits and published a book that synthesizes the Romanian research in this area*." Cristian Calude, Marian Gheorghe, Bucharest school of theoretical computer science, 2014 [7].

Figure 1. **Some of the books published by Leon Livovschi**

In this regard, Professor Dragos Vaida recently stated "Informatica was born to us in the years 1955-1957, the Institute of Physics (IFA) of the Romanian Academy and the University of Bucharest (UB) Faculty of Mathematics and Physics, currently Mathematics and Computer Science. They were thus represented at this debut, academia different, have highlighted the links between domains distinguished by their level scientific and, I hasten to add, managerial - Academics Simion Stoilow, Horia Hulubei, and Gregory Moisil - can say even providential" [8].



"Discrete Vending machines are another area where Romanian experts have made important contributions in literature talking about" School of Bucharest. "Leon Livovschi (n. 1921) used first, global implications calculation of the automatic circuit design with contacts and relays (1952). Livovschi Leon is the author of methods of representation through graphs the evolution sequential machines, developing, in this regard, and algorithms for analysis and synthesis of sequential machines. Discrete automata initial study was done using classical mathematical logic. Gr.C. Moisil (1906-1973, academician 1948) extended this mathematical tool, using imaginary Galois (1954) study, also in addition to the Relay type changeover valve elements (diode), as relays with intermediate elements, criotroni etc.". Ştefan Iancu, the Romanian Academy, 2007, NOEMA VOL. VI, 2007, http://www.noema.crifst.ro/ (.pdf)

4 Octavian Bâscă's contributions to the formation of generations of computer scientists

Octavian C. Bâscă (1947-2003) was an outstanding graduate of the school of computer science founded by Grigore Moisil the Faculty of Mathematics and Physics, and took from it "relay race" and the most important issues on the development of informatics, and computer use in the development of Romanian Society. Born on April 26th 1947 in Craiova as a high school student was twice Mathematical Olympiad International Romania to (IMO), winning second prize (Moscow, 1964) and third prize (Berlin, 1965).

In 1970 he graduated "Computer machines" specialization, founded by Acad. Grigore Moisil in 1960, at the Faculty of Mathematics, University of Bucharest. In 1977 he obtained his PhD in Computer Science/Informatics doctoral thesis "Storage systems and information retrieval". He taught a variety of courses and seminars: Computing machines, Data structures, Operating systems and telecontrol data, Databases and economic applications (UNESCO), Coding theory and data structures, Basic programming, Differential equations and Mathematics Analysis, Combinatorics and Graph Theory, Fundamentals of Informatics, Data structures and algorithms, Operating systems, Computing, Software for mini and microcomputers, Databases, Distributed computing, Advanced data processing methods, Algorithms and graph theory.

Figure 2. **Alumni 1970 – Computer Machines Section, witnessed the founding of the Romanian Informatics**

He was a Lecturer (1977-1991), Associate professor , since 1991, and vicedean (1992-1996) at the Faculty of Mathematics of Bucharest. In 1998 he transferred to the Department of Computer Science at the Faculty of Mathematics and Informatics, University of Pitesti, together with colleagues from Bucharest: Tudor Bălănescu and Luminița State. The contest commission from the faculty and the university confirmed professorship obtaining the contest, but the committee from the ministry did not validate this. He was disappointed that the ministry does not have its own Commission data confirming lecturer and teacher (math commission exists when only one informatician). Subsequently, the committee was set up and by the law of 2011, confirming associate professor and full professor positions are approved by the university senate. For a long time, the Ministry of Informatics was considered a discipline of Mathematics, later in 2005, by the Bologna-defined at European level is the undergraduate, master's and doctoral (different field of Computers and Information Technology). Since 1992, the Faculty of Computer Science of Iasi is the only faculty in the country's own Informatics. In Bucharest, however, in 1993, the UB Computer Center (CCUB) founded by Gregory Moisil disbanded. At the Faculty of Mathematics, there were discussions ,over time, on the establishment of a Faculty of Informatics initiated by some professors of informatics. Failed as a faculty, the name changed to "Faculty of Mathematics and Computer Science" since 2002.

Figure 3. **Some of the books published by Octavian C. Bâscă**

Having been a student, I went through Octavian Basque books, operating systems and telecontrol data, delivered in 1976, lithographed as published in 1976 (250 pp.) at Bucharest University Press. Notes appear as bibliography of 21 titles, many of which very recent at that time: AT Bertztiss, Data Structures, Theory and Practices, Academic Press, New York and London, 1971; M.V. Wilkes, operating multiple access systems, Technical Publishing, 1974; D.E. Knuth, Art of Computer programming, Technical Publishing, 1974. Compared with mathematics, where a mathematician studies a variety of topics, in Informatics domain an informatician is forced to study a wide variety of topics, given the two Components-hardware and software, and their rapid evolution, However , it is for practical applications for solving a wide variety of fields of society.

Figure 4. **Alumni 1978 – Informatics Section, witnessed the founding of the Romanian Informatics**

Octavian Bâscă was one of the most admired computer science professors from the Faculty of Mathematics. Today, new information technologies reached Informatics and IT, I hope that scientific and educational efforts to be an example for new generations, and to be known to those interested in the development of science.

Professors of this generation of computer scientists were: Solomon Marcus, Livovschi Leon, Mircea Malița, Popovici Constantin, Văduva Ion, Tomescu Ioan, Cuculescu Ion, Vaida Dragoş, Andreian Cazacu Cabiria (Dean), Dincă George (ViceDean), Nicolae Radu (Prodecan), Viorel Iftimie, Petre P. Teodorescu, Mocanu Petre, Gavril Sâmboan, Liviu Nicolescu, Niță Constantin, Vraciu Constantin, Mocanu Petre, Ichim Ion, Craiu Virgil, Florea Dorel, Mihnea Georgeta, Sirețchi Gheorghe, Anton Ştefănescu, Constantin Tudor, Gabriela Licea, Dumitrecu Monica, Sergiu Rudeanu, Virgil Căzănescu, Georgescu Horia, Bâscă Octavian, Atanasiu Adrian, State Luminița, Ion Roşca, Popescu Ileana, Popescu Liliana.

Conclusions. The need for *computer* was not the dream of a scientist or an inventor, although some teachers or scientists we can not argue with seemingly have different arguments from history and are particular cases. It was the way (product) that combined and used a variety of effective solutions offered by science and technology to solve practical problems they faced in the period 1940-1960 the powerful nations of the world: USA, USSR and UK. The main issues that were major and urgent were even military-defense and conquest of outer space, the last issue is still a major problem for defense. Factors that influenced the conception, design and development of computer systems are factors scientific, technological, social, cultural, economic, political, military, etc. At the level of individuals in a society, it can be said that the destiny and their lives are influenced by the factors outlined above. No need to come up with arguments or examples, simple study biographies of scientists, artists and others, etc., who lived in different periods of history, and this will be enlightening for anyone.

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Predictable questions as a must before Instructional Design process

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Abstract

„Accurate learning" as "authentic learning" is a relatively old[1] teaching method in universal culture, but is difficult to put in practice due to ergonomic reasons. Even so, we put forward the necessity of defining certain standards by which this will be subject to at least one primary goal: systematic teaching method that engages students in learning and applying knowledge as well as in acquiring skills through a complex, structured and systematic didactic project that comprises events and tasks relevant to the real world. IT devices are already used in marketing, advertising and media and of course education. These hardware devices offer the possibility of a wide interaction with information, more than static reading and memorizing an interaction of a complex type, multi-sensorial, having the possibility to work with both real and virtual entities, getting very close to what we call virtual reality. Combining eLearning as a didactic technology with project-based learning as a method and using a IT platform as a workspace, we define "full rich multimedia interactive content" as a component of education which can be define within the instructional design process.

Keywords: Inquiry-based learning, learning methods, inspirational digital resources, scientific research activities for students, authentic learning

1. Introduction

The AeL Digital Content is usually developed to support the educational process and designed to cover the scientific content required by the curricula, presented in a modern, attractive aspect. It proposes an exhaustive approach of the subject relying on learning methods that enhance the educational performance and therefore, contribute, by achieving the instructional objectives, to the development of skills, aptitudes and abilities required by both the curriculum and the needs of the social and professional insertion of the students.

The Content is developed and organized accordingly to the individual instructional plan, starting with elementary notions and up to advanced notions, offering an ideal formula for the blended courses.

Each learning resource has clearly defined educational attributes and precise educational objectives dedicated to the subject at hand and required by the curriculum. The major advantage of a modular approach of the learning process is the possibility to structure the courses according to the curriculum, but with a view to the students various levels of understanding and perception.

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[1] John Dewey (1859 –1952) philosopher, American psychologist and educator who defines for the first time in 1919 the concept of „hands-on learning".

The cognitive strategies used in the lessons are open, heuristic, problem oriented. They are complementary to acknowledged instructional algorithms, while the active-participative methods used contribute to develop in Students' 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 learners take an active part in the construction of their 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.

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 Students face at their work places.

The AeL Digital Content has the following advantages:

- It permits the multi-sensorial stimulation, thus enabling the students to make use of their personal characteristics/attributes/resources during the learning process.
- It encourages the learner to explore and research on his own
- It provides a large variety of sources of information;
- It stimulates creativity by personal implication into the learning process;
- It introduces target oriented learning (operationally defined objectives)
- It creates motives, it causes and it encourages the exploratory and creative approach of knowledge
- Allows for exchanging information and cooperation in the achievement of some work tasks;
- It stimulates critical thinking;

Students participate directly and the learning process is achieved through experimentation and participation. Solutions to some difficulties of classical education are provided not only at the level of the instructional props available throughout the multimedia resources but also by the fact that the teacher can build customized courses according to the level of his students. Constant feedback has a major contribution to the continuous monitoring of the way in which knowledge is accumulated.

2. Questions

The first and the main process in the eContent development activity is Instructional Designer. In the following pages we will answer to some legitimate questions that are mandatory to be put in the first place before the development team starts to create.

2.1. Question 1: Please describe how you will define requirements, and adopt suitable approaches for the variety of learning outcomes across different subjects

Requirements elicitation and documentation will be two-fold:

- At project level;
- At subject level;

Project level requirements will be more focused on the overall needs, expectations, issues and objectives, defined at project level by the main project stakeholders.

Subject level requirements will be differentiated, will comply with project level requirements and additionally, will gather critical inputs for the instructional design process of each subject, based on a vast array of inputs:

- Current classroom practice and difficulties;
- Learning activities that are difficult to address in a traditional classroom environment e.g. abstract representations, dangerous experiments;
- Curriculum analysis, to envisage the vast array of learning situations and learning outcomes through project implementation and the overall vision at subject level;
- Specific instructional models used and how digital activities can enhance teaching and learning;
- Delivery methods used and associated needs;

These requirements, translated into a pedagogic approach, will provide the underlying pedagogy in the design and development of learning resources for each subject.

There is no silver bullet in defining an approach for a specific subject, as the type of digital learning activities to be developed will have to comply with current practice in order to be easily and successfully integrated within the teaching and learning process.

However, for each subject we will define the underlying learning theories, activity types and design patterns needed to accomplish the overall objective which can later be applied within the instructional design process, at learning objective level.

For languages, the focus will be on the main classroom practice - reading, writing, speaking and listening – providing teachers with activities such as:

- Drill and practice, enable students to develop fluent retrieval of information in practical contexts, especially in applying grammar and terminology;
- Drama activities alongside quizzes to assess listening comprehension;
- Essay writing and cloze activities with formative feedback to support and guide students in writing practice using specific grammar rules or terminology;
- Writing games, such as crosswords, find the words to support students in the development of their vocabulary;
- Formative assessment to correct misconceptions, reinforce key knowledge and support meta-cognition;
- Mind games, such as flash cards to enable students to create connections and develop fluent retrieval in a fun and engaging manner;
- Readings, to assess reading comprehension;
- Listening, to assess listening comprehension;
- Verbalize, to assess speaking comprehension and to enable students to identify any gaps in their learning or understanding;
- Sentence sequencing, for grammar rules and terminology;
- Avatar presentations with voice-over, for information presentation, as students tend to be more receptive when human faces are presenting specific information;

For STEM subjects, including Mathematics and Science, the focus will be on instructional interactivity and teaching for understanding, promoting transfer of abstract concepts into real-world, using activities such as:

- Games, environmental and mathematical simulations to enable learners to discover new knowledge, try out their growing skills and monitor their progress; Such activities are critical to show reasons for learning and relevance of taught information in a real world context;
- Problem solving and guided analysis with formative feedback, as learners learn most from feedback provided as they learn;
- Cite examples activities that provide evidence based assessment of learners progress;
- Animations, showcasing information that is not visible with naked-eye e.g. a very fast chemical reaction;

- Compare and contrast activities, pressing contrasting examples that promote transfer and abstraction among students;
- Video presentations with voice-over of real-world practice activities, as videos are very powerful in changing behaviour and skills transfer;

Many other factors will influence the approach for each subject, such as:

- The need for collaborative learning activities, that can be translated in activities for interactive whiteboard, such as trivia or collaborative games where several students can work together on the interactive whiteboard, providing a very engaging dynamic in the classroom;
- Delivery method, as teacher-led activities and learner-centred activities require a very different tailoring of learning activities.

2.2. Question 2: Please describe how you will adopt different development methodologies based on the differing requirements of the various subjects

The development methodology will be impacted by the specificities of each subject. Some subjects require more input from the instructional designers in order to specify complex activities while others require more input from mentors in content-based cultural sensitive subjects such as languages. All these differences will have to be reflected by the development process, with different steps and different involvement from project team members.

For STEM subject, including mathematics and science, the focus will be on complex interactions and representations, such as simulations, problem-solving activities or process animations. In this case:

- The main focus will be on the instructional designer, having to create complex activities that require high-level specifications, research and outstanding interaction design that promotes instructional interactivity in authentic and meaningful learning situations;
- Instructional designers will need more time to specify concepts provided by mentors into learning activities;
- Instructional designers will need to have increased communication with local mentors to validate specific concepts, interactions and learning situations;
- The storyboard developed by the Instructional Designer will have to be more detailed in a visual manner, providing several screen for each learning activity to showcase interactivities before mentors can fully validate the storyboard;

For languages, focus will be on content itself, with mentors being directly involved in the design of learning activities, alongside instructional designers. In languages:

- Mentors will have to design the learning activities alongside the instructional design team;
- Learning activities and interactions being less complex, communication will be mainly on the final storyboard;
- More effort will be added to content creation, such as audios, videos, illustrations and animations;
- Professional actors and recording studies will be added in the workflow for producing audios and videos, requiring additional validations from mentors;

Apart from these subject-specific differentiations, there are other factors that may impact the development methodology. For example, content delivery on interactive whiteboards will require additional rounds of quality control on low-contrast devices.

2.3. Question 3: Please describe how you will design learning experiences that are engaging and suitable for Grade N learners

Learners' engagement in the learning process is a critical success factor and one that is more and more difficult to address due to the ubiquity of rich multimedia content available for students as games, applications and movies. In this regard, SIVECO has a vast array of techniques to engage and motive students, as described below.

Figure 1. **Educational game and Problem solving and guided analysis with formative feedback**

Game Mechanics

Game mechanics will be used to support initial learning, as the first steps are the most difficult in getting a grasp on the knowledge base of a specific topic. Games are very powerful as we often see students failing tens of times but still trying until they succeed and this is something we want to add to our learning objects.

An innovative set of game mechanics (Schonfeld, 2010) is going to be used when appropriate, with techniques such as:

- Rewards/Achievements/Badges or a virtual representation of having accomplished a given task;
- Avoidance, by not instituting a negative reward if the learners manages to do a given task;
- Status and cascading information theory for complex activities where skills have to be improved as new information is presented;
- Communal discovery in collaborative activities, with students having to discover and share knowledge in order to solve a given task;
- Blissful productivity for drill and practice activities as students are happier when they work hard;
- Countdown, but only used in assessment activities, to create a sense of urgency that will motivate learners;

However, implementation of such techniques will be designed with great care, at the end of the learning activity and not after each action as students tend to develop shortcuts and have a tendency to work for the rewards rather than for the learning goals (Peters, 2014).

Authentic and meaningful learning situations

Students will become more engaged and motivated if they find reason for learning and instant application of key information in the real word (Wheeler & John, 2008). In this regard, SIVECO always draws child personas and learning profiles for Grade 10 students to help instructional designers to better design authentic and meaningful learning situations.

Interactivity

Interactivity, alongside variety, are two of the main benefits of digital learning objects from the traditional textbooks, managing to actively engage students and motivate them to learn (Horton, 2011). Interactivity is embedded in all learning objects developed by SIVECO.

Moreover, as interactivity can sometimes do more harm than good (Edwards, 2015), SIVECO is using a framework for designing instructional interactivities (Context-Challenge-Activity-

Feedback) in order to engage students with powerful and authentic interactions that are relevant in a real-world context.

Variety

Variety is critical for learners' engagement (Horton, 2011). SIVECO has developed in time a vast array of learning activities deeply rooted in pedagogic practice and engaging for students which are used as a base for future developments. This includes but is not limited to alpha ladder, analogy, formative assessment, avatar presentation, case study, checklist, classification, crossword, drawing, readings, find the words, flash cards, hotspot, jigsaw puzzle, listening, map, mind map, mnemonic, gallery, sentence sequencing, trivia, timeline, reduce information, rhyme factory, verbalise, video presentation, word selection, mathematical simulations, environmental simulations, cite-examples, case studies or guided-search.

Background interactivity

Apart from the instructional interactivity that directly supports the learning objective, we always use background interactivity that will increase the realism of a given activity although it does not directly address the learning outcomes e.g. tress slightly moving.

However, background interactivity is integrated with great care in order not to increase the extraneous processing.

Reducing extraneous processing

Having a limited cognitive workload that we want to be focused on the actual learning rather than details or how to use the user interface (Peters, 2014), we always remove false interactions, additional content that will not support the learning objective and provide outstanding usability so that learners won't feel overwhelmed by the amount of content or interactions, which is a common mistake in instructional design.

Audio and visual effects

Audio and visual effects are two of the most powerful tools for engaging students and fairly easy to implement. Apart from user interface sounds, audio and visual effects are used when they support the learning objective e.g. showcasing the sonic boom but also as part of game mechanics e.g. fireworks for successfully completion of a very complex task.

Differentiated learning

Students will be engaged as long as they are appropriately challenged. If a task is too difficult or trivial for them, they will lose their motivation to learn. In this regard, SIVECO is using differentiated learning techniques to appropriately challenge learners such as:

- Cascading information theory for complex activities, releasing new information as students get a grasp on current tasks;
- Instructional scaffolding, providing support for learners through their Zone of Proximal Development (Vygotsky, 1978) through structured feedback;

Make use of students' prior knowledge

Enabling students to bring their past experiences to current learning situations is very engaging for students (Peters, 2014), helps them to better understand the subject and caters for better transfer. Our instructional designers always promote the use of students' prior knowledge when designing learning activities.

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Methodological guidelines for the development of university course examination ontologies

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Abstract

Educational ontologies provide efficient software tools for knowledge representation in the case of e-learning systems, web-based education and intelligent tutoring systems. Starting from EduOntoFrame, a framework for the design of a general educational ontology for university didactical activities (teaching, learning, examination), the paper proposes a set of methodological guidelines for university course examination ontology development. Under the EduOntoFrame framework, a general university course ontology is composed by university teaching ontologies, university learning ontologies and university examination ontologies. In the case of a university course examination ontology, the university course teaching ontologies are the basic resources for the development of the knowledge base with questions, problems, exercises and answers. Also, such an ontology will include some course examination terms, which are course-independent. An example of using the proposed guidelines for a university course examination ontology development is presented.

Keywords: Educational ontologies, Methodology, University course examination

1 Introduction

University educational ontologies include concepts and terms specific to all three phases of any university course didactical activity: teaching, learning and examination. They provide efficient software tools for university course knowledge representation and sharing between teachers and students, under e-learning systems, web-based education systems and intelligent tutoring systems. Most of the educational ontologies reported in the literature use particular methodologies or frameworks for their development. Some examples are given (Alert et al., 2006; Doan and Bourda, 2006; Boyce and Pahl, 2007; Grigore et al., 2013). We have proposed in (Oprea, 2013) a general framework, *EduOntoFrame*, for educational ontologies development. Starting from this general framework we have designed a methodology sketch for university course examination ontology development in a similar way with the methodology sketch proposed for university course teaching ontology development that was introduced in (Oprea, 2014). The university course examination ontology and the university course teaching ontology are interrelated due to the use of the teaching ontology in the course examination ontology. Thus, the course examination ontology is based on the course teaching ontology as a mandatory request.

The paper is organized as follows. A set of methodological guidelines for university course examination ontology development is introduced in the next section. After that, an example of course examination ontology for the course of Computer Programming Languages, generated with the proposed guidelines set, is presented. The final section concludes the paper.

2 Methodological guidelines for university course examination ontology development

The general view of the course examination activity is shown in Figure 1. During the examination activity, the student will have to solve certain problems, tests, exercises or other forms of course examination either offline or online (e.g. computer-based examination with a certain time deadline constraint or in a traditional form of course examination as is student-teacher face to face interaction). The course examination ontology can be developed starting from the *EduOntoFrame* general framework proposed in (Oprea, 2014). The framework generates eight ontologies: course teaching ontologies (four ontologies), course learning ontologies (two ontologies) and course examination ontologies (two ontologies).

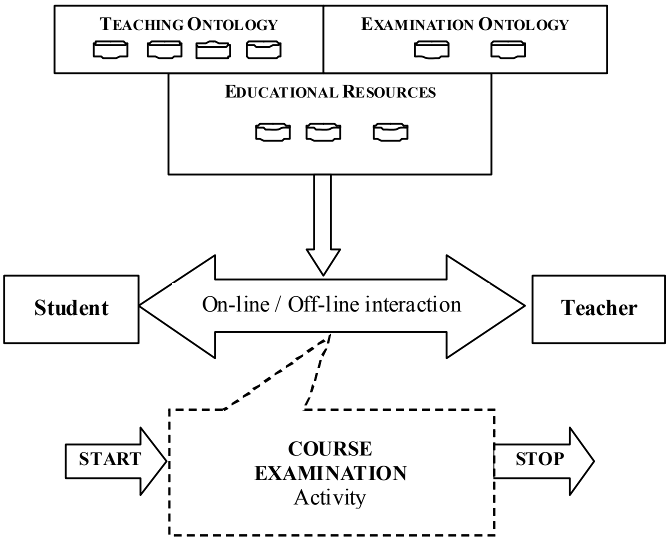

Figure 1. **A general view of the university course examination activity**

The two course examination ontologies (Course Examination Ontology – CE and Course Basic Examination Ontology – CBE) are shown in Figure 2. The CBE Ontology is a course independent ontology and includes concepts and terms specific to any university course examination activity.

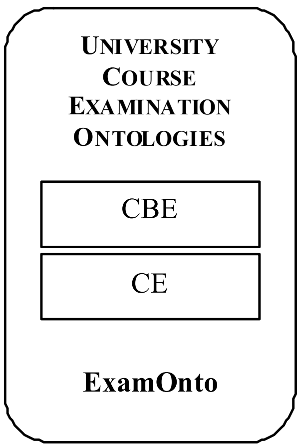

Figure 2. **The university course examination ontologies generated by the *EduOntoFrame* general framework**

The course examination ontology (ExamOnto = {CBE, CE}) is generated by using the following methodological guidelines set.

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Methodological Guidelines Set

Input*:* Course, Course Teaching Ontology (*TeachOnto*);
Output: *ExamOnto*

1. identify or take (from existing educational ontologies) the basic concepts of any university course examination activity;
2. *ExamOnto* ← basic university course examination concepts;
3. link to *ExamOnto* the corresponding university course teaching ontology (*TeachOnto*);
4. identify the specific course examination concepts (basic and advanced) from *TeachOnto*;
5. add to *ExamOnto* the specific course examination concepts (basic and advanced);
6. return *ExamOnto*;

****

Figure 3 shows the structure of the university course examination ontology. Examples of terms included in the *ExamOnto* ontology are:

- examination method, examination feedback, assessment, self-assessment, exercises, individualized exercises, questions, tests, problems, simple problems, complex problems, theoretical problems, research experiments, written and oral examination, computer-assisted examination, student synthesis capacity, student analysis capacity, mark, student level etc.

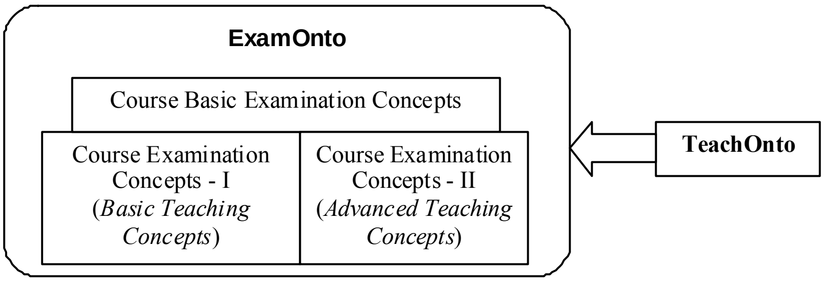

Figure 3. **The structure of the university course examination ontology (*ExamOnto*)**

3 Example of university course examination ontology

We have applied the methodological guidelines for the development of a university course examination ontology in the domain of Computer Science, for Computer Programming subdomain.

The course examination ontology named ProgramExamOnto was developed for the course of Computer Programming Languages by following the guidelines given in the previous section. We have considered that the following computer programming languages were teached to the undergraduate students: Pascal, C and C++. A prototyped ontology was implemented in Protégé 4.1, a Java-based ontology editor. Figure 4 presents a screenshot with some classes of this prototype ontology, which can be extended with more concepts.

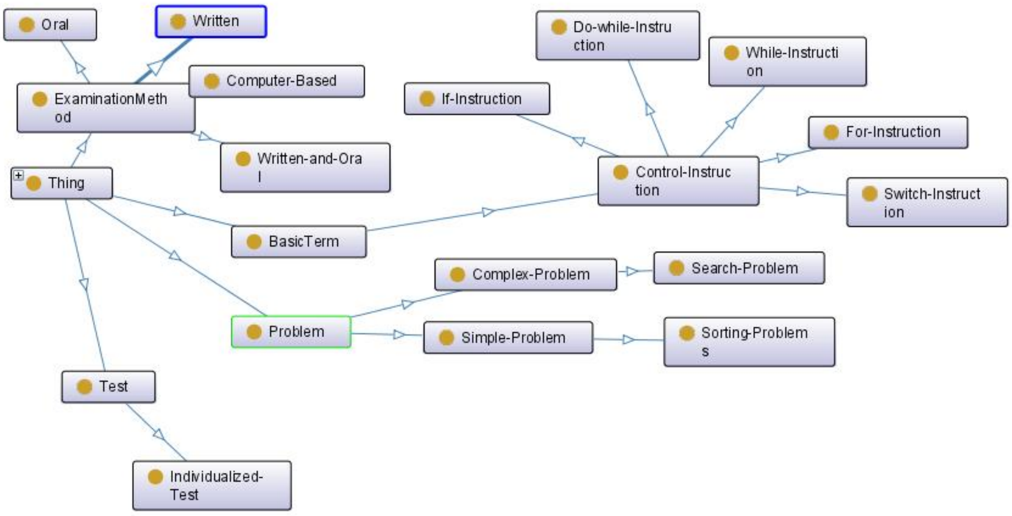

Figure 4. **A screenshot with some classes of the university course examination ontology, *ProgramExamOnto*, in Protégé 4.1 (OntoGraph)**

Examples of Computer Programming Languages course specific concepts are: control instruction, if instruction, while instruction, for instruction, simple problem, complex problem, sorting problem, search problem.

The course examination ontology can be used by teachers and students for university course examinations performed through various computer or network-based educational systems such as web-based systems, collaborative networks or e-learning platforms.

4 Conclusion

The paper proposed a set of methodological guidelines for the development of a university course examination ontology, ExamOnto, based on the EduOntoFrame educational ontology development framework. An example of such ontology for the domain of Computer Programming Languages was presented.

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A conceptual model for Open Learning Environments

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Abstract

Over the last years, the growing ubiquity of Social Media, the emerging mobile technologies and the augmented reality become more deeply integrated into the teaching-learning process and also create new opportunities for reinventing the way in which educational actors both perceive and access learning. Major challenges in academia that involve tremendous development and innovation are blended courses/flipped classrooms integrating Social Media (SM), Open Educational Resources (OER) and Massive Open Online Courses (MOOC). After an analysis of the emerging technologies, trends and theories in education, the paper proposes a conceptual model for Open Learning Environments, with characteristics divided in three categories: pedagogical, social and technological. Also it presents an original classification of the existent learning environments which integrate open technologies and practices.

1 Introduction

Many articles and studies present innovative approaches in education that have been supported by Social Media and new educational technologies (Conole and Alevizou, 2010; Hamid, Chang and Kurnia, 2011). Blogs, microblogs, social networks, media sharing sites, social bookmarking systems, wikis, social aggregation and virtual worlds are increasingly used by students and teachers in the teaching-learning process, in research and in professional development, for communication and collaboration, for sharing resources or for building Personal Learning Environments.

In this context, the classic institutional Learning Management Systems, that have dominated the academia landscape since the middle of 90s, connecting the user to university resources, regulations, help, and educational content, are considered too inflexible, offering an instructivist model of education. Personal Learning Environments (PLE) and social LMS (LMS integrating social networks/ collaboration) are now taken in account by many universities which search solutions for the coexistence and interoperability between LMSs and open educational technologies. Which would be the characteristics of an innovative learning environment integrating open educational technologies and practices ? In order to define such a model, in the following we identify the emerging technologies, trends and theories in education.

2 Emerging Educational Technologies

In order to determine the new educational trends and technologies we have studied the reports produced by the New Media Consortium (NMC) Horizon Project (HP), an initiative launched in 2002, that charts the landscape of emerging technologies for teaching, learning, research and creative inquiry.

Table 1 depicts the trends in using technology in education, as resulting from the HP reports (HPRs) published over the last eight years, between 2008-2015. The emerging technologies are classified according to the adoption time in three categories: one year or less, two to three years and four to five years (NMC, 2008-2015). Between parenthesis, for each of the three categories of 2015, there are presented also two technologies published in the short list of the draft report (NMC, 2015a).

Table 1. **Emerging technologies in education as reported by HPRs 2008-2015**

HPR	One Year or Less	Two to Three Years	Four to Five Years
2008	- Grassroots Video - *Collaboration Webs*	- Mobile Broadband - Data Mashups	- *Collective Intelligence* - Social OSs
2009	- *Mobiles* - Cloud Computing	- Geo- Everything - The Personal Web	- Semantic Aware Apps - Smart Objects
2010	- *Mobile Computing* - *Open Content*	- Electronic Books - *Simple Augmented Reality*	- Gesture-Based Computing - *Visual Data Analysis*
2011	- Electronic Books - *Mobiles*	- *Augmented Reality* - Game-Based Learning	- Game-Based Learning - *Learning Analytics*
2012	- *Mobile Applications* - Tablet Computing	- Gesture-Based Computing - *Learning Analytics*	- Gesture-Based Computing - Internet of Things
2013	- *MOOCs* - Tablet Computing	- Games&Gamification - *Learning Analytics*	- 3D Printing - Wearable Technology
2014	- *Flipped Classroom* - *Learning Analytics*	- 3D Printing - Games and Gamification	- Quantified Self - Virtual Assistants
2015	- Bring Your Own Device (BYOD) - *Flipped Classroom* *(- Learning Analytics)* *(-Mobile Apps)*	- Makerspaces - Wearable Technology *(- Collaborative Environments)* (-Games&Gamification)	- Adaptive Learning Technologies - The Internet of Things (- Wireless Power) (- Flexible Displays)

We selected the following emerging technologies that have been expected for adoption between 2008-2015 (in italics in Table 1), considering they give the effectiveness and openness to the open learning environments:

- *Mobile Applications* (the term is similar or close/connected to *Mobile Learning, Tablet Computing, Bring Your Own Device* and *Electronic Books*)
- *Open Content*
- *Augmented Reality*
- *Learning Analytics* (as part of the *Visual Data Analysis* trend in HR2010)
- *Massively Open Online Courses*
- *Flipped Classroom*
- *Collaborative Environments* (*Collaboration Webs*).

3 Open Educational Practices and New Learning Theories

Open Educational Practices (OEP) are defined as "the range of practices around the creation, use and management of Open Educational Resources with the intent to improve quality and innovate education" (OPAL, 2011).

In a broader vision, Open Educational Practices (OEP) mean a transition from a resource based learning and outcomes based assessment, to a learning process in which learners participate actively in social processes, in judging, reflection and innovation (Conole, 2013).

Behaviorism, cognitivism, and constructivism are learning theories used to design instructional environments before technology to influence and to be integrated in teaching/learning processes.

Open education, governed by Open Educational Practices, implying collaborative learning processes enabled by emerging technologies, is connected with new learning theories, for which an overview can be found in (Dron and Anderson, 2014). Theoretical key concepts for new learning theories are given below.

a. *Connectivism* states that "knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks"; knowledge is "the set of connections formed by actions and experience" (Siemens, 2005). Connections to social networks for information creation, storing, sharing, and retrieval, but also incorporation of social networking tools to facilitate the flow and exchange of information within a network are important aspects in designing learning environments based on Connectivism (Williams and Whyte, 2011). "Connectivism is built on an assumption of a constructivist model of learning, with the learner at the centre, connecting and constructing knowledge in a context that includes not only external networks and groups but also his or her own histories and predilections" (Anderson and Dron, 2011).

b. *Learning communities* are groups of people learning together through communication and collaboration; a community could be nurtured by a facilitator; it is possible to include not only the participants in a course, but also external learners and experts, thus becoming a distributed learning community. The principles for building successful learning community announced by Downes in 2001, are still valid (Downes, 2001):focus on learning materials;creation of a sense of whole;integrate content and communication;appreciate participant-generated content;on-going communication between members;access to multiple resources and information;educational orientation;sense of history.

c. *Produsage* is "the collaborative and continuous building and extending of existing content in pursuit of further improvement", users being both creators and consumers of information and knowledge in collaborative networks (Bruns, 2007). The produsage exhibits the following aspects:

- is community-based – the community has to be large and varied enough so that members can contribute more than a closed team of (qualified) producers;
- fluid roles – produsers' participation depends on their personal skills, interests, and knowledge;
- unfinished artefacts – content artefacts in produsage projects are continually under development, following evolutionary, iterative, palimpsestic paths;
- common property, individual merit – contributors permit (non-commercial) community use, adaptation, and further development of their intellectual property (free licenses), being rewarded by the status capital gained through this process.

Flexible academic environments are needed which cultivate the collaborative, creative, critical and communicative capacities of digital students, and support them in building learning and produsage communities.

3A Conceptual Model for Open Learning Environments

A learning environment is a unique combination of pedagogical, social and technological components (Kirschner et al., 2004). Founded on our research and experience in designing and implementing collaborative platforms (Holotescu, 2015), in Table 2 we define the characteristics of effective Open Learning Environments based on emerging educational technologies and open educational practices identified and presented before, the characteristics being divided in three categories: pedagogical, social and technological.

Figure 1 is a use case for an Open Learning Environment following the principles stated in Table 2.

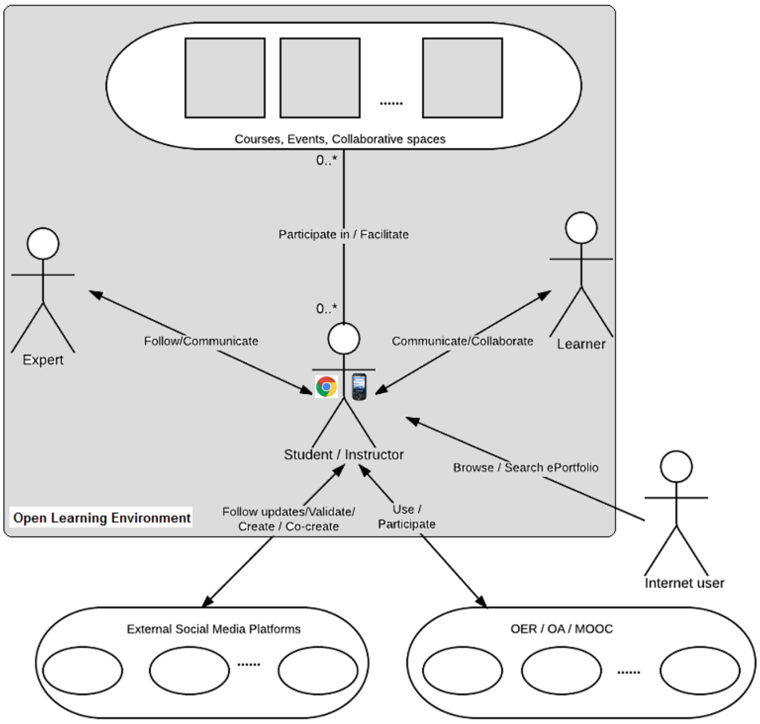

Figure 1. **Use case for an Open Learning Environment**

Table 2. **Characteristics of Open Learning Environments**

Type	No	Characteristic	Description
Pedagogical	1.	Open Educational Resources	Course content extended with Open Educational Resources / Open Access materials / MOOCs proposed by teachers, learners and/or automatically recommended.
	2.	Learners as content co-creators	The content is not created solely by faculty members, but can be collaboratively co-created by students enrolled in that course.
	3.	Collaborative/ distributed assessment; Learning Analytics	Peer and collaborative/distributed assessment have to be integrated, together with issues related to copyright, ownership, security and privacy; optimizing and understanding learning using data about learners.
Social	4.	Interactions with external learners and experts	The students' interactions with external learners and experts on different Social Media platforms could bring new insights on content and enlarge it, could validate the course content.
	5.	Collaborative applications and platforms	Students choose and use different distributed (free) collaborative applications and platforms for their group/cooperative work, also for communication with external participants and experts.
	6.	Public PLE	Students build public profiles/portfolios during courses, which can be extended/used in future courses; also their previous/tacit knowledge could be assessed for a better personalization of the course.

	7.	Time-persistency/ Retrieval	The environments should be *time-persistent* (Mott and Wiley, 2013): an important aim would be to continue the collaboration between participants (and facilitator) after the course end, to maintain access to the course content and interaction, and to assure a continuity of the learning community. Also the content and interaction should be retrieved using different search terms.
	8.	Teacher training/sharing Learning Design	Teachers should continuously learn/improve knowledge and skills in communities of practice, validate and improve learning scenarios, benefit of shadow mentoring from more experienced colleagues and be able to visit/learn from the virtual spaces facilitated by other peers.
Technological	9.	Institutional /administrative management features/privacy assurance	A balance between imperatives of institutional networks and the promise of the cloud to be achieved (Mott, 2010).
	10.	Mobile Learning	Mobile learning is supported and encouraged: students can use mobile devices for a better management of their work (inside and outside educational institution).

All these mean to break the walls of the university amphitheaters and of the Learning Management Systems toward collaborative platforms, external experts and learners, to use Open Educational Resources and Practices. Also to flip the classrooms integrating MOOCs and content co-created by students, supporting them in building persistent PLEs.

4 Classification of learning environments integrating new technologies

The projects and experiences reported in literature we have evaluated have lead us to the following classifications of the learning environments integrating emerging educational technologies and open educational practices:

a. *Enhanced LMSs*: In most projects, the courses are enhanced with interactions on Social Media platforms, without an integration in LMS: communication and content co-creation on wikis, blogs, RSS, collaborative bookmarking systems (Holotescu and Naaji, 2007; Bennett et al., 2012), social networks such as Facebook (Grosseck et al., 2011; Rasiah and Ratneswary, 2014), microblogs (Ebner and Maurer, 2008; Holotescu and Crețu, 2013). In these cases the time-persistency characteristic of the students' portfolio and of the course content is missing because they are (at least partially) located on LMSs or on other platforms. Launched in January 2015, Facebook at Work (facebook.com/help/work) could be a new solution for creating learning communities on this social network; it enables the communication, interaction and collaboration over documents with co-workers/peers, assuring the privacy. Popescu (2015) provides a classification and synthesis of the approaches in social media-based environments for educational use.

b. *Integrated LMSs*: Integrating collaborative tools and connecting Social Media with Learning Management Systems: BYU OLN (Mott, 2010), COOPER - Collaborative Open Environment for Project Centered Learning (Bongio et al., 2006), DIMPLE (Andone, 2011), eLearnTS (Holotescu et al., 2007), eMUSE (Popescu, 2012), iCamp (Wild, 2009), Moodle, Google's Course Builder, an Open Source LMS, offering the possibility to host MOOCs, which integrates Google Social Media/collaborative educational tools (Jacoby, 2014). Interoperability standards, such as LTI and Caliper standards, can be used for exchange of data, roster, context between LMSs and external networks (IMS Caliper, 2013; Hill, 2014). This category limits the possible interaction with external learners and experts, and the visibility of the built PLEs.

c. *Widgets Networks*: Integrating administrative and assessment LMS specific features in general social networks, such as ROLE widgets integrated in Facebook or LinkedIn (Faltin et al., 2013). This case could be a solution only for specific courses, thus there is a little chance to establish continuous PLEs and learning or practice communities of students/teachers.

d. *Dedicated Networks*: Building dedicated learning social networks that host virtual spaces for courses: NeoLMS (formerly Edu2.0) (Ivanova, 2009), LearnWorlds, attaCommunity (called the Facebook for learning), Edmodo or ProjectCampus (projectcampus.us is a collaborative platform for group work, which integrates applications such as Dropbox, Google Drive or Kaltura and can be connected with LMSs like Moodle, Blackboard and Canvas). Such educational networks limit the possibility to interact with external experts and learners, to activate on a large category of social networks, and also the openness of the PLEs created by participants.

5 An Open Learning Environment based on Micro-blogging

Building the learning community on general/open social networks extends learning with ubiquity and informal characteristics: "connecting learning community with personal and business network of a user makes user experience more live and dynamic supporting practice sharing and exchange" (Faltin et al., 2013).

In 2008, we have started the research on Microblogging, this Social Media technology being very new at that moment, with only a few applications in education; this fact represented for us a challenging domain to be explored (Grosseck and Holotescu, 2008).

Comparing the proposed characteristics of an Open Learning Environment (Table 2) with those of an open microblogging platform, we can note that an environment based on microbloggingoffers the premises for:

- communication and collaboration,
- content sharing and co-creation,
- mobile learning,
- openness to Open Educational Resources,
- connections with other Social Media platforms, and
- time-persistency of content and portfolios.

An open microblogging platform:

- with integrated learning management features,
- with collaborative/distributed students' assessment and Learning Analytics,
- with the possibility for teachers training and Learning Design sharing,

would become an Open Learning Environment, following the model proposed before.

Thus, we selected microblogging as the base technology for the learning platform we developed, called Cirip, that evolved in an effective open learning environment for formal and informal settings (Holotescu, 2015).

6 Conclusions

We have proposed a conceptual model for Open Learning Environments founded on emerging educational technologies and theories, with characteristics divided in three categories: pedagogical, social and technological.

The model can be used and validated by research teams in implementing learning platforms based on different technologies.

In our case, we mapped the requirements of the microblogging framework onto the features of the open learning environment model, implementing the educational multimedia microblogging platform called Cirip.

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Expanding Web and Innovation Skills for 21st Century

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Abstract

Gathering the opinion of educators, education experts and executives collective vision for learning known as the Framework for 21st Century Learning has been constructed. According to this Framework, students must master innovative skills and expertise novel knowledge in order to succeed in comprehensive and competitive workenvironments and life that becomes more and more complex each new day. An emphasis is made on creativity, critical thinking, communication and collaboration mentioned as essential to adapt students to the future.In that article, we try to figure out how developing the Web content and technology innovations influenced onquality of learning process and help students acquiring the needed skills.

Keywords: Web4.0, quality of education, Framework for 21st Century Learning

1. Introduction

In last decades, the technology innovations enter in all ranges of our life, and in all levels of education. Hugeamount of digital data, toolsand level of connectivity now exist linkingeducators to different resources andsupportingactive and effective learning process(http://www. innovationsforlearning.org/). It is proven that the success in life is not tied to IQ (intelligence quotient) but instead to EQ (emotional quotient).Thus, the effective learningsystems must presentinformation designed to provoke an emotional response in the learner (Wilson, 2009).

The intention of article is to explain how Web technology innovations support and influence on the quality of learning process and how educators should be prepared for that challenge.

2. Learning innovationsand quality ofeducation

Learning is the process that needed clear and well-performed information given to the persons that are involved in. In our days, students have a possibility to choose and be active when accepted and acquire new knowledge. That is way to make your subject attractive to them the creator of website should follow some rules to insure achieving a good results.

Website quality and performance is improving rapidly when we follow some ideas (http://website-quality.blogspot.com/2009/02/increase-website-page-rank.html):

- *Focus on your aim (subject, business etc.);*
- *Get response or feedbacks from our students – it can be test relevant to the topic, or survey with simple questions about usefulness of the site, their satisfaction from process of learning and opinion how to improve it;*
- *Build quality links;*
- *Build targeted backlinks;*
- *Try to exchange link with other sites (Not often);*
- *Do not link to 404 error page;*
- *Analyze before accepting the links from others.*

Today, neuroscientific research leads to the conclusion that, without emotion, there can be no effective long-term memory formation. Study after study confirms that the more emotionality a passage or event evokes, the easier it is to remember (Wilson, 2009).

2.1. Framework for 21st Century Learning

With the assistance of educators, involving education experts, business leadersand students, P21's Framework for 21st Century Learninghave been established (fig.1), to define and illustrate the skills and knowledge that students need with main purpose to succeed in their work and life, as well as the support systems necessary for 21st century learning outcomes (http://www.p21.org/our-work/p21-framework).

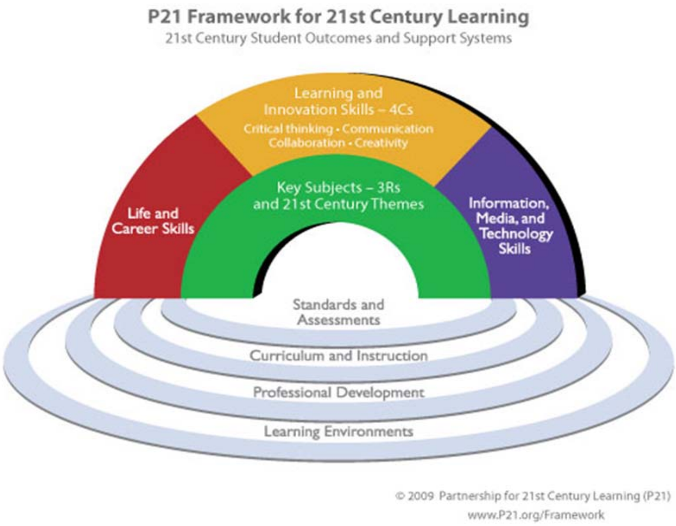

Figure 1. **P21's Framework for 21st Century Learning**

Earlier wehavelook overon the basic characteristics of the different types of Web involving in educationas well as for the Web 4.0, which are important for e-learning practice: *development intelligent agents, mobile technologies, cloud computing and services* (Nedeva and Dineva, 2012). In addition, we have assessed how these innovations influence on the student successes and performance during exams (Pehlivanova et al. 2009) and on the quality of learning (Pehlivanova et al. 2011). The major skills achieved from students thought applying Web 4.0 learning innovations leads in developing *critical thinking, communication, collaboration and creativity* (fig.1), and that enhance learning quality.

2.2. Expansionsofweb content and quality of learning

From its foundation until now the web appears with its main purpose to link information and make communication and exchange of that information easy. The web was growing as **Web 0.0** - *Developping the internet*; **Web 0.1** -*The shopping carts & static web;***Web 2.0 -***The writing and participating web*;**Web 3.0 -***The semantic executing web;* and until nowadays **Web 4.0** - *"Mobile Web"***-** as a space of interconnected web pages, web apps, videos, photos, and interactive content (http://www.evolutionoftheweb.com/). The principal differences between all types of web can beclarified as a function of two parameters "*degree of information connectivity*" and "*social connectivity*" (fig.2).

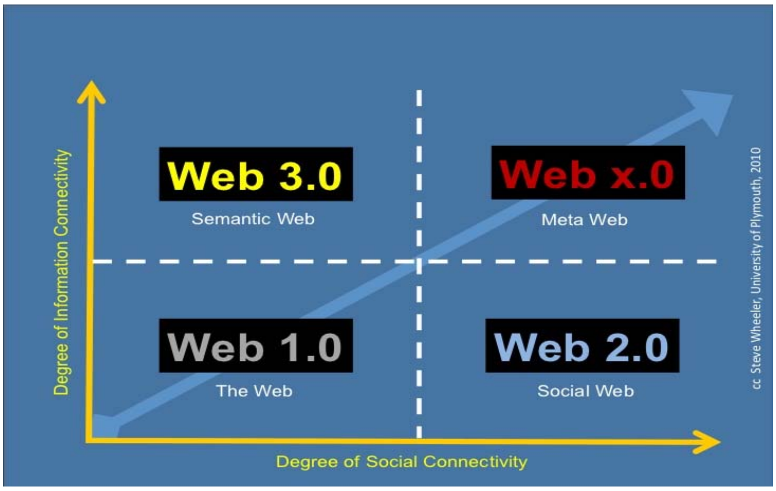

Figure 2. **Developing of Web as degree of information connectivity and social connectivity**

Web 1.0 is merely a data gateway where users passively receive information without opportunity to post reviews, comments, and feedback. Web 2.0 references as a social web; it encourages participation, collaboration, and information sharing. Examples of Web 2.0 applications are YouTube, Wiki, Flickr, Facebook, and so on. The innovative in Web 3.0, is that the computers can interpret information like humans and intelligently generate and dispense useful content personalized to the needs of users (Cookie, 2012).

Nevertheless, there is no clear definition for Web 4.0 in the internet, but it can be expresses as *Web 3.0 + Artificial Intelligence = Web 4.0 technology* (http://website-quality.blogspot.com/2010/01/web-40-new-web-technology.html).

In fact, Web 4.0 connects all devices in the real and virtual world in real-time (https://flatworldbusiness.wordpress.com/flat-education/previously/web-1-0-vs-web-2-0-vs-web-3-0-a-bird-eye-on-the-definition/). Our previous surveys showed that students liked the opportunities to use lecture information, multimedia and self-exanimated tests all over the time when they have it and that improve their motivation for learning and study quality (Pehlivanova et al. 2009, 2011).

Currently web is “emotionally” neutral and does not perceive the users feel and emotions, but soon followed Web expansion willappears **Web 5.0** – *emotional web* (fig.3), which is about the emotional interaction between humans and computers. In the future, with headphones on, users will interact with content that interacts with their emotions or changes in facial recognition (https://flatworldbusiness.wordpress.com/flat-education/previously/web-1-0-vs-web-2-0-vs-web-3-0-a-bird-eye-on-the-definition/).

Innovativeodds that offer Web-based learning made the education process more attractive and pleasing to students. In our previous study 80% of students confirmed that e-learning is more outstanding and interesting than ordinary one and cause positive emotions (Dineva and Ducheva, 2011). In modern society, emotions have ceased to be a negative element to become a positive one that facilitates action and decision-making. In case, studyon the enjoyment of the Web 5.0 activities, gained full agreement from all students with a mean of 4.85 (out of 5). The students’ responses about their willingness to access Web activities outside class time showed agreement from all students with a mean of 4.42(out of 5). Overall, the students showed positive attitudes toward the use of the Web 5.0, agreed that they enjoyed the Web 5.0 activities and would like to use more activities during and outside class time(Benito-Osorio et al., 2013).

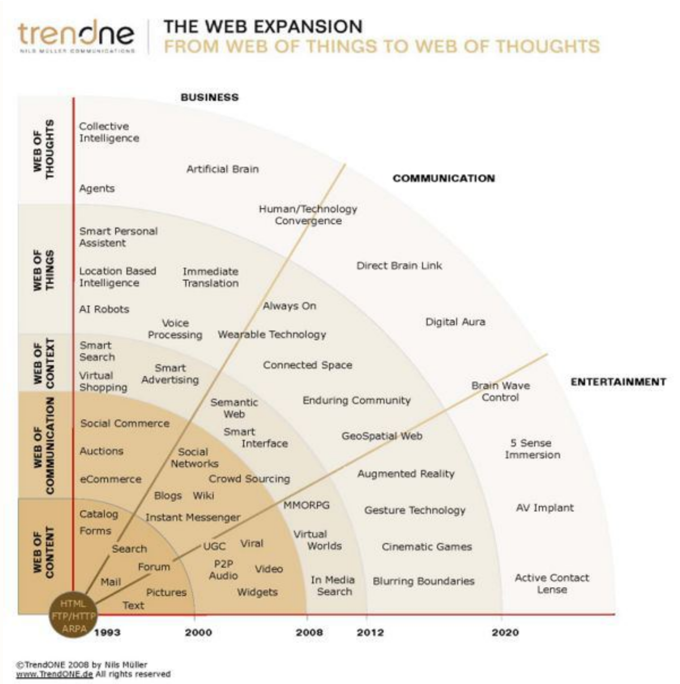

Figure 3. **Web expansion from Web.1 to Web.5**
(https://flatworldbusiness.wordpress.com/flat-education/previously/web-1-0-vs-web-2-0-vs-web-3-0-a-bird-eye-on-the-definition/)

2.3. Emotions Affect Learning

In fact, if the informationthat perceive in the situation fails to provoke an emotional response, it will fail to be perceived as meaningful and will consequently have little chance of being selected into our long-term memory sets (Wilson, 2009).As a result no learning appears. Emotions are often thought of as irrational or "nonintellectual" feelings that are beyond our control. However, emotions are complex states of mind and body, consisting of physiological, behavioral, and cognitive reactions to situations that can be managed and directed (Darling-Hammond et al., 2015), taking into account that:

- ✓ ***Emotions affect learning*** –students' emotionsaffect learning, interfering with or supporting learning.
- ✓ ***Emotional intelligence*** – that is the ability to manage feelings and relationships.There are five aspects of "emotional intelligence",andeducators should develop strategies to help themselves and their students become aware of and manage their emotions.
- ✓ ***Creating emotionally safe learning environments*** –students can take risks intellectual risks without penalties for failure, because learning environment is supportive.Thus, they develop self-confidencegrow emotionally and academically.

Emotionsare important part in education, because they drives attention andpushes learning and memory. There are no fully understanding of our emotional system, so it is difficult to regulate it in school, but some general principles and their applications to the classroom can be listed(Sylwester, 1994):

- ✓ *When trying to solve a problem, carry on the dialogue with continuous emotional input* - developing forms of self-control among students and staff that encourage non-judgmental, no disruptive and perhaps even inefficient emitting of emotion.

- ✓ *Focus more on metacognitive activities that encourage students to talk about their emotions*, listen to their classmates' feelings, and think about the motivations of people who enter their curricular world.
- ✓ *Activities that emphasize social interaction and that engage the entire body tend to provide the most emotional support* - games, discussions, field trips, interactive projects, cooperative learning, physical education and etc..
- ✓ *School activities that draw out emotions - simulations, role playing, and cooperative projects - may provide important contextual memory prompts* that will help students recall the information during closely related events in the real world.
- ✓ *Avoiding emotionally stressful school environments that are counterproductive because they can reduce students' ability to learn*.

3. Conclusion

Applying Web 4.0 activities in the learning process cause achieving from students the major skills listed as important in the Framework for 21st Century Learning.Web technology innovations support acquiring and developing*critical thinking, communication, collaboration and creativity.*

Emotionsare important part in education and communication.For effective pedagogy in Web 5.0 environments, teachers need to become active and critical Web 5.0 users and develop their own skills and strategies for selecting and managing Web 5.0 materials and emotions (Diana Benito-Osorio et al., 2013). It is very important to develop advanceemotional intelligence in students and academic stuff. Institutionsand educatorsshould pay attention to the coming challenges with expansion of the Web (emotional web – web 5.0) and create emotionally safe learning environments, maintain activities that emphasize social interaction- games, discussions, field trips, interactive projects, cooperative learning.

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The Evolution of the Web, http://www.evolutionoftheweb.com/

Using innovative tools and technology-enhanced learning spaces to support effective learning, https://www.jisc.ac.uk/rd/projects/e-learning-innovation

Web 1.0 vs Web 2.0 vs Web 3.0 vs Web 4.0 vs Web 5.0 – A bird's eye on the evolution and definition, https://flatworldbusiness.wordpress.com/flat-education/previously/web-1-0-vs-web-2-0-vs-web-3-0-a-bird-eye-on-the-definition/

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Intelligent e-Learning with New Web Technologies

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Abstract

Technology innovations with Web 4.0 influence on the quality of student learning and performance in blended learning. Development of the Web technology extends the capabilities of the recent e-learning. The report analyses the changes that occur in e-learning in accordance with the evolution of the World Wide Web. Web 3.0, Web 4.0 and trends in Web 5.0 to outline the new features of e-learning. Artificial Inteligence with Big Data, Linked Data, Cloud Computing, Data Driven science put different emphasis on e-learning. 'The Semantic Web will connect all the Web's data and information much more closely, enabling contextually based search and research. The Internet of Things will let Web-connected machines of all kinds communicate with each other and with us, creating a rich flow of data about their location and status.

Keywords: Intelligent e-learning, e-learning characteristics, technology innovations, Web 3.0, Web 4.0, Web 5.0

1 Introduction

Developing information society creates prerequisites and conditions for faster access to data and information exchange through the Internet worldwide, not just in an individual country. New computer technology is changing the content and application practices in e-learning. The consequent applications of all multimedia and simulation technologies, computer-mediated communication and communities, and Internet-based support for individual and distance learning have the potential for revolutionary improvements in Education (McArthur et al., 1993).At present, many e-learning tools with varying functionality and purposes exist (Aroyo&Dicheva, 2002; Murray et al., 2003).With the new technologies implementing artificial intelligence the functions and the role of the consultant or the trainer will be supplemented by software agents that can fulfil other function in order to help the learners. E-learning will complement training staff, allowing them to train more learners, more quickly, and effectively(Nedeva&Nedev, 2008).

The aim of the report is to identify, summarize and complement the characteristics of e-learning in conjunction with the rapid development of Web 4.0 and Web 5.0-based study of literature.

2 Evolution of the Web to Web 5.0

Web 3.0 services are content-oriented, semantic-based, context-sensitive services based on technologies supporting semantically enriched websites that might support portable ID's in order to use the Web as a database and an operating system (Murugesan&San, 2009).Wheeler (2009) predicts that Web 3.0 "not only promote learning that is more richly collaborative, it also enable learners to come closer to learning 'anytime, anyplace' and provide intelligent solutions to web searching, document management and organisation of content". Ohler (2008a; 2008b) offers three areas where the Semantic Web will impact education: *knowledge construction, personal learning network maintenance, and personal educational administration*.The Web 3.5 is the transition towards the “Intelligent Web”. According to Harshal and Hayatnarkar (2007) in Web 3.5 there are fully pervasive services based on matured and embraced semantic technologies, to be upgraded to the next level of sophistication. Latest technologies of Web 3.0 are included in the Web 3.5 and will be fully matured within Web 4.0.Each new period in the evolution of the World Wide Web has transformed the way business is conducted and companies themselves (Kambil, 2008). Main characteristics of web 4.0 important for e-learning are analyzed by (Nedeva&Dineva, 2012).

The Web 4.0 (The Intelligent Web) - services will be autonomous, proactive, and content exploring, self-learning, collaborative, and content-generating agents based on fully matured semantic and reasoning technologies as well as AI. Examples might be services interacting with sensors and implants, natural language services, or virtual reality services. Web 4.0 is known as symbiotic web, meaning interaction between humans and machines in symbiosis (Hemnath, 2010).Web 4.0 is called also “Mobile Web”,a space of interconnected web pages, web apps, videos, photos, and interactive content (http://www.evolutionoftheweb.com/). However, until now, there is no exact idea about web 4.0 and its technologies, but the web is moving toward using artificial intelligence to become as an intelligent web (Aghaei et.al, 2012).Actually, Web 4.0 connects all devices in the real and virtual world in real-time (https://flatworldbusiness.wordpress.com/flat-education/previously/web-1-0-vs-web-2-0-vs-web-3-0-a-bird-eye-on-the-definition/).Web 4.0 based on wireless communication occupies the fourth step in the evolutionary process. For example, the GPS that guides cars and now helps drivers to improve the planned route or save fuel will shortly save them from having to handle it. This 4.0 or mobile version is ready to take off, with an apparently remote Web 5.0, the ‘‘sensitive’’ Web, hard on its heels (Kambil, 2008).

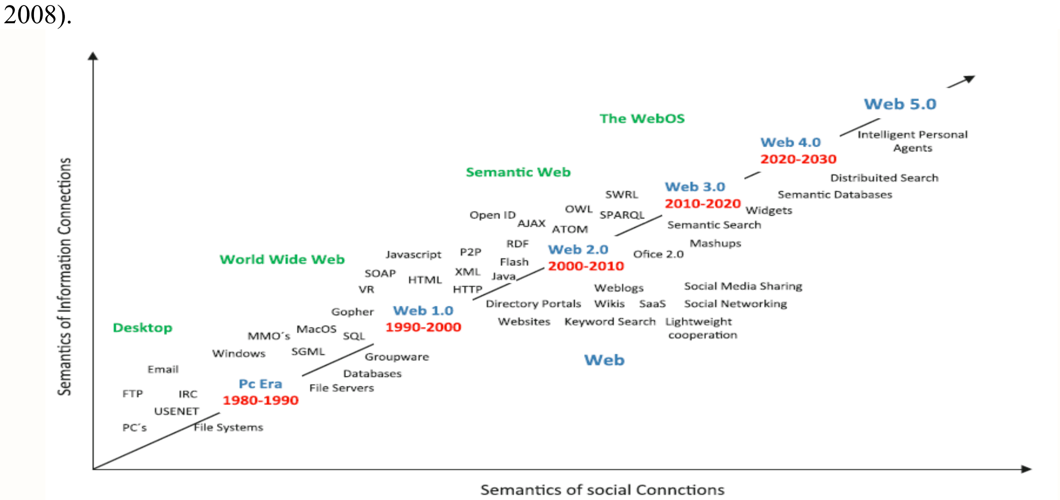

Fig. 1. **Evolution of World Wide Web. Source Own elaboration based on radar networks and NovaSpivack, 2007— www.radarnetworks.com**

Web 5.0, the sensory and emotive Web, is designed to develop computers that interact with human beings. Although at the moment the Web is ‘‘emotionally’’ neutral, that is, it does not perceive what users feel and although emotions are still difficult to map. In order to manage in this new scenario (although onlypotential as yet), teachers will have to master new competences and skills (Benito-Osorio, et al., 2013).Currently the Web is "emotionally" neutral: do not feel the user perceives. The company Emotive Systems has created, neuro technology through headphones that allow users to interact with content that meets their emotions or change in real time facial expression an "avatar" (Patel, 2013).

3 E-learning evolution

E-learning is an open system that blends access to information and purposeful communication into a dynamic and intellectually challenging learning community. E-learning fully integrate the benefits of personal freedom with connectivity (Garrison&Randy, 2011). Table 1presents new set of combined Semantic Web and E-learning characteristics for a holistic 3.0 E-learning model (Issa et al., 2015).

Table 1. **New set of combined semantic web and e-learning characteristics for a holistic 3.0 e-learning model (Ahmud-Boodoo ,2015)**

Main characteristic	Sub-characteristic
Content management	Content Creation
	Content Retrival
	Content Reuse
	Knowledge Representation
	Search
Usability and Accessibility	Interface Design
	Technology
	Student Centred Learning
	Collaboration
Collaboration	Student-Lecturer
	Peer-Peer
	Resource Sharing
	Group Activities
	Feedback
Teaching Principles/ Curriculum	Syllabus
	Course Sequencing
Teaching Principles/Pedagogy	Instructional Method
	Context
	Delivery Instrument
	Learning Theories
	Teaching Strategies
Personalized Learning	Student Model
	Learning and Cognitive Style
	Educational Cost
	Learning Participation
Support/Instructional	Activities
	Help
	Feedback
	Collaboration
Support/System	Student Centred Learning
	Organization Support
	Technology
	Training
	Infrastructure
Trust	Student-Lecturer
	Peer-Peer
	Technology
	System
	Security
Web 3.0 Ontology-Based Technology	Ontologies Database
	Content Database
	Records Database
	Hardware
	Software
	System Infrastructure

New characteristic of e-learning is adaptability offered by e-learning systems. Adaptability refers to the idea that technology-enhanced learning environments can automatically adapt needs and preferences of the learner. Such systems are usually referred to as Adaptive Educational Hypermedia Systems (Brusilovsky, 2001) or when accessible on the Web-Adaptive Web-based Educational Systems (Brusilovsky&Peylo, 2003).Adaptive educational systems use a model of individual user's characteristics -**user model**. (Brusilovsky, 2001). The user model is a representation of information about an individual user that is essential for an adaptive system to provide the adaptation effect, i.e. to behave differently for different users(Triantafillou et al., 2003).

Adaptive educational systems are able to perform several adaptive procedures. They are able to perform adaptive presentation; the system adapts the content according to the user's model; provide adaptive navigation support (Brusilovsky&Millan, 2007).Many types of intelligent learning systems are available, but five key components are common in most systems namely:*the student model, the expert model, the pedagogical module, the domain knowledge module, and the communication model*(Ma, 2006).

Recent development in computer-based educational systems resulting in a new generation of system encompassing intelligence, to increase their effectiveness; they are called Intelligent Educational Systems(IESs). Intelligent Tutoring Systems (ITSs) constitute a popular type of Intelligent Educational Systems (Brusilovsky, 1999). Adaptive Educational Hypermedia System (Brusilovsky,1998) are another type of educational system, specifically developed for hypertext environments such as WWW. Some authorssuggest two type of intelligent and adaptive Web tutors, called Intelligent Web-Enabled Tutors(Ma,2006). The first tutor supported students to think critically and suggest hypotheses, observations, and data while solving a case. The second tutor customized Web content based on student learning needs. The intelligent agent are able to initiate actions in order to achieve goals, thus being able to behave autonomously in an environment. They are several type of agents: *Cognitive Agents, Reflective Agent, Pedagogical Agent, Expert Agent, and Communication Agent.*

Cognitive Agent in REAL are software entities that carry out some set of operations on behalf of a User in a learning environment with some degree of autonomy, and in so doing, employ some knowledge or representation of the users it represents. *Reflective Agen*t represents the mental states of users. Build in Design Mode by the user, this agent combines the knowledge representations for the entity agents with specific rules to guide its actions. Like the entity agents, Reflective agent behaviors are constructed in the form of promotional networks, production rules and mental images. Instructional designers design the strategies in Pedagogical Agent. They may learn appropriate pedagogical practices for REAL applications in the design team as well as though pilot studies with some students. An *Expert Agent* exhibits mastery of knowledge in a domain and can perform a task in an optimized way. Discrepancies between the behaviors of the reflective and expert agents can be seen as missed concepts or misconceptions in student understanding and may lead to interventions within the game to help the user overcome his or her conceptual difficulties. A *Communication Agent* acts as a collaborator that facilitates user-computer interaction. It can be designed using Microsoft Agent, utilizing configurable featuressuch as speech, tonality, gesture, facial expression, gender, and screen navigation that can be combined together to emulate a human face-to-face communication act (Bai&Black, 2010).

Summarizing analyzed literature, we can review that the Intelligence and Adaptivity are essential features of e-learning and its Sub-Characteristics are: *Adaptive presentation; Adaptive navigation; Stimulating critically thinking and task solving; Intelligent analyzing and interactive student help*.

The Internet links more than 10 billion pages, creating an opportunity to adapt millions of instructional resources for individual learners by Web technologies. Three components drive this educational inflection point. They are *Artificial Intelligence (AI), cognitive science, and the Internet*(Woolf, Beverly Park, 2010).AI techniques contribute to self-improving tutors, in which tutors evaluate their own teaching (Issa&Isaas,2015). Most of AI's success so far has been primarily in ‘restricted’ domains where rules, settings and objectives are well defined, e.g. chess. In more open-ended domains such as education, the success of AI has been limited. This limitation primarily comes from the fact that open-ended domains are inherently more complex and therefore an AI system needs to contain many parameters, which in turn require many data for estimation and as a result require significant amounts of computational power (Rubens et al., 2014).Crucial components needed for the AI to succeed in more general open-ended domains starting to fall in place. There is a vast amount of data of available; importantly many of this data is “open” to a wide audience (Big Data). No matter how vast the dataset is it tends to provide a limited view on the problem. New technologies are allowing to establish links between these datasets as to obtain a more complete picture (Linked Data). The significant infrastructure needed to store and intelligently process this data is now becoming easily accessible and affordable (Cloud Computing). The new scientific framework is becoming available for supporting AI in the process of scientific discovery (Data-driven Science) (Rubens et al., 2014).

AI - Big data. Web data contains a precious resource – intelligence and is therefore often referred to as “Web Intelligence”(Zhong et al., 2000). This intelligence needs to be extracted and utilized, and AI is a perfect tool for accomplishing this objective. We consider that the role of Web 2.0 was to enable data production, and the role of Web 3.0 will be to enable utilization of this data.

AI – Linked data. However, we along with many others (Marshall&Shipman, 2003)believe that semantic linking is overly ambitious and is yet hard to achieve on the wide and general scale due to inherent ambiguity of natural language. However, this does not mean that the data could not be linked and utilized. In order to widen the linking objectives the concept of “Linked Data” has been recently developed (Fischetti, 2010).There has been a number of success of using AI to produce the needed links that even captures some of the semantics e.g. folksonomy (Halpin et al., 2007).

AI – Cloud computing. Processing and analyzing large quantities of data requires significant computational resources as well as frameworks to make these resources easily accessible. A variety of competitively priced cloud computing services are becoming available, e.g. Amazon’s AWS, Google’s App Engine, Microsoft’s Azure to name a few. In addition, a number of supporting frameworks has been developed that made the power of computational clouds easily accessible, e.g. a widely adopted Hadoop/MapReduce, and a more specialized ones such as Mahout, Hive, Pig, Oozie, and Rhipe (Rubens et al., 2014).

AI – Data driven science. Recently large number of datasets have become available for little or no cost (Rubens et al., 2011). Data-driven science is starting to gain a foothold in the education, as indicated by the rapid development and increasing applications in the new areas of educational data mining (EDM) (Baker&Yacef,2009),and learning analytics (Siemens, 2010).

Analyzed characteristics of e-learning related to the development of Web technologies can be presented in summary form in the following table (Table 2):

Table 2. **New set of combined web and e-learning characteristics**

<table>
<tr><td rowspan="4">Web 3.0</td><td rowspan="4">Intelligence and Adaptivity</td><td>Adaptive presentation</td></tr>
<tr><td>Adaptive navigation</td></tr>
<tr><td>Stimulating critically thinking and task solving</td></tr>
<tr><td>Intelligent analyzing and interactive student help</td></tr>
<tr><td rowspan="4">Web 3.0 and Web 4.0</td><td rowspan="4">Artificial Intelligence (AI)</td><td>Big data</td></tr>
<tr><td>Linked data</td></tr>
<tr><td>Cloud computing</td></tr>
<tr><td>Data driven science</td></tr>
<tr><td rowspan="4">Web 4.0 and Web 5.0</td><td rowspan="2">Artificial Intelligence (AI)</td><td>AI tutor for collaboration and transparent</td></tr>
<tr><td>Intelligent personal agent</td></tr>
<tr><td rowspan="2">The sensory and emotive web</td><td>New interaction with human beings</td></tr>
<tr><td>New competency and skills for teachers</td></tr>
</table>

4 Conclusion

The report is an attempt to continue the classification and description of the characteristics of e-learning from other authors (Issa&Isaas, 2015), with the latest achievements in the development of Web 4.0 and Web 5.0. New features of e-learning following the evolution of Web technologiesare identified.Applying Web 4.0 and Web 5.0 activities,we support acquiring and developing*critical thinking, communication, collaboration and creativity.*

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Trends in the assessment of students for the role of blended learning for development of skills for lifelong learning

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Abstract

Surveys among the students from different disciplines and courses in the Faculty of Technics and Technologies Yambol related to possibilities and perspectives of e- and blended learning enables us to make a comparative analysis of the evaluation of the students and find tendencies within 4 years period. According to the results of the survey we can claim that there is a steady trend of positive evaluation of the possibilities of e- and blended learning for individualization of the learning process, development of the cognitive sphere of the personality, improving the interaction with the professors, stimulating the performances and creativity of the students, improving the organization of the process, creating a positive atmosphere, improving possibilities for evaluating the academic achievement of students and the development of objective self-assessment. Data processing and results analysis of questionnaires gives us reason to say that by e- and blended learning improves the quality of education. It is more convenient, more attractive and helps to achieve high levels of Bloom's taxonomy, which are associated with acquiring factual, conceptual, procedural and metacognitive knowledge of students.

Keywords: blended learning, development of cognitive skills, lifelong learning

1 Introduction

Preparation of specialists for all areas of the economy and changing demands of the society required rethinking the concept of education and goes beyond the sphere of formal education and only traditional forms of learning. This trend requires a new understanding of the quality and effectiveness of teaching and learning. The using the various forms of e- and blended learning have a positive impact on their efficiency and effectiveness (Garrison, Kanuka, 2004). By integrating of the traditional and e-learning are created conditions for overcoming the spatial and temporal limitations (Aspden, Helm, 2004), creating a virtual learning environment, changing the way of thinking and consideration of the learning as a continuous process aimed at the personal and the professional development of the students.

2 Theoretical Background

In order to realize the European National Strategy for lifelong learning is necessary to change not only the organization and structure of training in high schoolbut also the approaches to learning. The integration of elements of the traditional and e-learning is related to the redesign of teaching and combining of the possibilities for effectiveness and socialization of learning environments using the technological opportunities for active learning. Blended learning allows to be formulating didactic concepts that reflect the different educational content and different audiences. One of the main positive aspects of this approach and the kind of training is that is carried out better differentiation and individualization, which in turn is a prerequisite for increasing student motivation.

The term "blend" has an English origin and means "harmonization", "mixing the two elements", "act of combining into one." (Webster dictionary)

The different researchers attempt to define and clarify the concept of blended learning. From the concept and definitions in the dictionaries can be displayed some of its main features:

- „a way of learning that combines traditional classroom lessons with lessons that use computer technology and may be given over the internet"; „*Blended learning is a way of breaking down barriers to education*". (Cambridge dictonary)
- an organic integration of designed and purposefully selected technologies that complement each other – face-to-face and online approaches; innovation that includes teaching and learning in a new way (Garrison and Vaughan, 2008);
- a form of training / a course in which are provided base information, presentations, online articles, etc. in the face-to-face training, but in our opinion this is not sufficient basis for define it as blended course. By Pedagogical and methodological point of view we accept the opinion of some researchers that in blended learning is important concretisation and formulation of educational goals that are able to realize online or through traditional training (Lloyd-Smith, 2010);
- model "bricks and clicks", which is very cost effective and provides "a new design for the new economy and the new generations of students"(Bleed, 2001);
- combination of online and face to face training as an essential part of the content is delivered online using online discussions and a limited number of face to face meetings (to determine training as blended, between 30% and 79% of learning activities must take place online, and the rest – through traditional) (Allen, Seaman and Garrett , 2007);
- striving on restructuring the learning process from a separate units to a connected and continuous process, combination of a traditional and training using the Internet that based on the idea that teaching / learning is not a one-off or incidentally event, but a continuous process (Singh, 2003);
- a pedagogical approach that combines the opportunities for effectiveness and for socialization of the classroom with technologically advanced active learning opportunities in the online environment ... (Dziuban, Hartmanand Moskal, 2004);
- integration of face-to-face and online learning caused by the necessity and effort to meet the needs of different students, to provide compelling and meaningful educational experience and optimize the resources of higher education (Innovative Practices Research Project).

Based on the literature review, we can conclude that blended learning is defined as: a form of training, pedagogical approach, integration, model, innovation and as a complete redesign of the educational environment, goals and approaches of traditional training in order to achieve higher quality and effectiveness in the preparation of specialists. The increased number of theoretical and applied research works and practices in the field of blended learning are caused not only by economic motives (dynamics of the labour market, better use of resources and lower cost of educational services, the need for additional professional qualifications and specializations) but also by pedagogical reasons related to improving the flexibility of the organization and fundamental changes in approaches to teaching and learning and the use of interactive methods.

Recent studies for the acceptance and use of e- and blended learning in higher education institutions shows that this process has started and developed unequal in different countries and universities, and that more professors and students understand the role of implementing the concept of lifelong learning and personal development. Via e- and blended learning allows for implementation of formal, non-formal and informal education that makes it possible to involve the majority of those who want to learn by combining professional, personal and other commitments and plans with opportunities for learning and improvement.

Some of advantages of a blended learning are:

- offers a varied choice for the provision and development of educational content;
- complete involvement of students through different options and formats of presentation of educational content
- possibility for different learning activities, meeting and developing different learning styles;
- overcome the barriers to communication face to face
- individual pace of work
- opportunity to advance understanding of the statement and comments
- inclusive environment and increased interaction for the rich and varied experience;
- increased activity in the preliminary self-study on educational content and opportunities for discussion and development of critical thinking;
- optimal use of the resources of the university (qualified lecturers and classrooms).

3. Design of the study

The survey was conducted with two questionnaires in the 4-year period. The questions in the two surveys are different in formulation and options for answers, but some of them are semantically close, which allows us to do comparative analysis. Formulated questions are related to the experience of the students in work e- and blended learning. Part of the questions seek the opinion of students on the possibilities for individualization and develop their cognitive skills. The students had the opportunity to rank their assessments of the advantages of a blended learning as a convenient, attractive, and understandable. The other questions seek the opinion of the students in order to improving the teaching and adapting of the level of difficulty of self-work towards the opportunities, needs and interests of students.

The study included students from regular and part-time training of various professional fields and majors.

4. Results and Analysis

In the processing the received data, surveyed students were grouped according to their age and belonging to the corresponding generation of the 20th century according to the classification of Howeand Strauss(Howe and Strauss2000). In the first survey of all students are so called Y-generation. Students completed the second questionnaire were divided into 3 groups according to which generation they are related. The majority (87%) belong to the Y-generation, but since in the studies contingent are students of part-time training, there are representatives of X-generation and a small part – of the "baby-boom" generation. In studies of the specific characteristics of generations, we expected that students will express different opinions and attitudes towards the use of e- and blended learning.

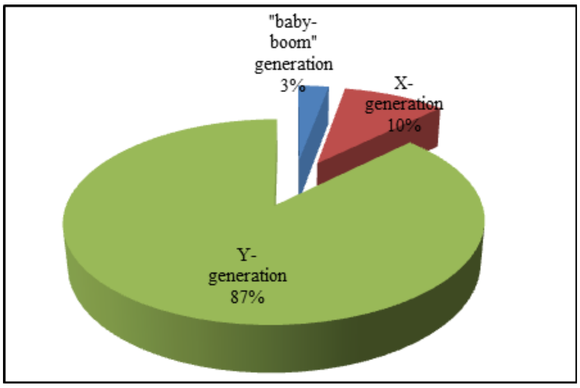

Figure 1. **Distribution of Students by Age**

Since the majority of the surveyed students belong to the Y-generation, they have grown up during the digital revolution and are influenced by it, and virtual "facilities" they should accept e- and blended forms of learning with satisfaction and feel in them "in their waters."

Upon comparing the results of both questionnaires are observed that where the predominant group is representatives of the Y-generation, the negative answers to the question for experience and knowledge in e- and blended learning are almost three times less. Our preliminary expectations that in both surveys there will be no significant difference in the responses of the students for their experience in e- and blended learning weren't confirmed.

The results of the second questionnaire showed that the highest percentage of representatives of the X-generation, who have knowledge about the e- and blended learning are followed by Y-generation and expected the highest percentage of unfamiliar with the implementation of ICT in education it is at the “baby-boomers”.

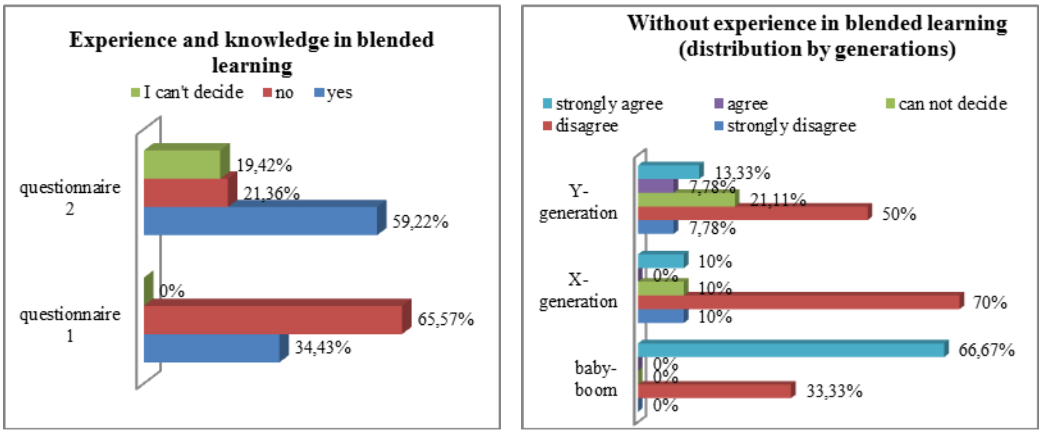

Figure 2. **Experience and knowledge of the students in e- and blended learning**

There is a positive trend in the attitude and evaluation of surveyed students to the possibilities of blended training for development of intellectual skills and creativity. More than half strongly indicated opportunities for the development of intellectual skills and another large part accept that these skills are developed partly.

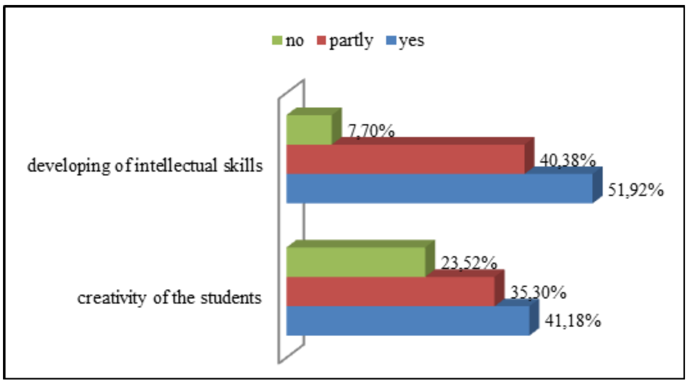

Figure 3. **Assessment of blended learning for development of creative skills**

Were established a similar trend for the development of creativity, where the majority of the respondents were completely or partially agree. These data give us the reason to say that members of Y-generation not only use the modern technology as tools but as an opportunity to develop the potential of their intellect and personality.

The results of our research are similar to the requirements of employers, that the preparation has to encourage and develop in the future specialists qualities as initiative, mobility, adaptability, active models of behaviour that will help them in their future realization. In the foreground of the results it appears that blended learning is a model that allows for the development students' "multiple intelligences", their ability for self-education and self-improvement, and the opportunity for realizing of their personal potential. The expansion of the share of blended learning and the development of online courses would contribute to the improving of competitiveness of the future specialists and faculty as an educational organization.

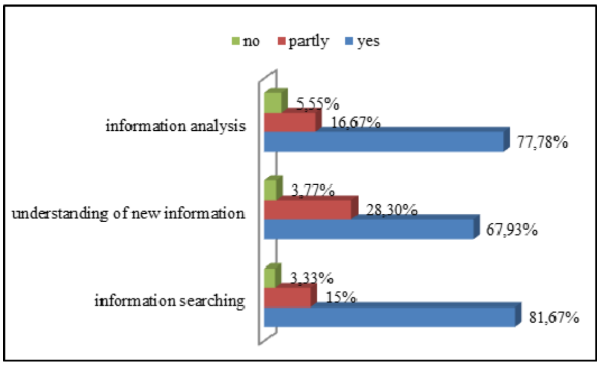

Figure 4. **Developing the skills for working with information**

The analysis of the results of the first survey, which reflect the views of the students to development of their skills to work with information shows that the highest is the percentage of the surveyed who think that e- and blended learning gives an opportunities for increasing the skills for search in the global information network in various scientific arrays and libraries, allowing them to seeing and follow up trends in a particular scientific fields and different positions on the matters of their interests. We can explain the results with the peculiarities of Y-generation, which is characterized by speed and multi-channel in perception of information, maintaining a continuous connection with WEB, striving for access to a wide variety of information sources.

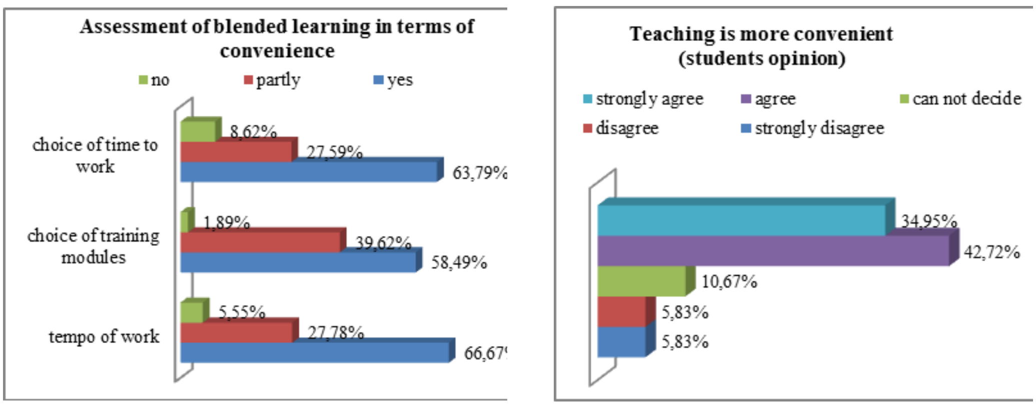

Figure 5. **Blended learning is convenient**

Another trend that speaks for the benefit of blended learning and in tune with the views and the results of other scientists, is the assessment of the students for the advantage of this type of training that is related with the choice of time to work, choice of training modules and tempo of work that are tailored to individual feature. Data and analysis from our study confirm some major advantages.

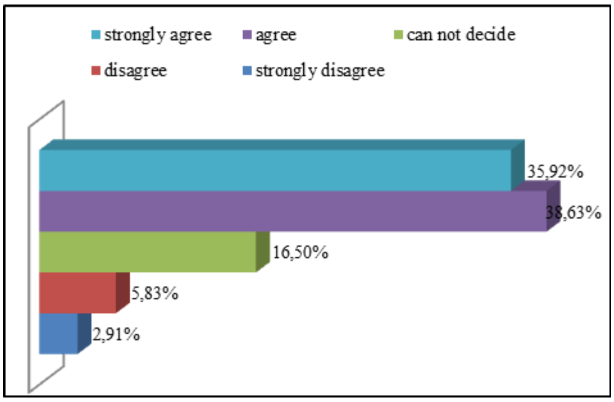

Figure 6. **Blended learning is more attractive**

Most students defined blended learning as more attractive, because it contain the various formats - text files, audio, video, graphics and more. Through it successfully are integrated strategic and pedagogical approaches to ensure the implementation of modern technologies, create innovative practices that motivate student learning. Since the majority of the students in the faculty belong to the Y-generation, but there are also other generations, i.e. traditional and non-traditional students, the majority of them accept easily the application of different types of technology in education, which helps them to realize the social nature of knowledge – cooperative and collaborative learning, teamwork and others.

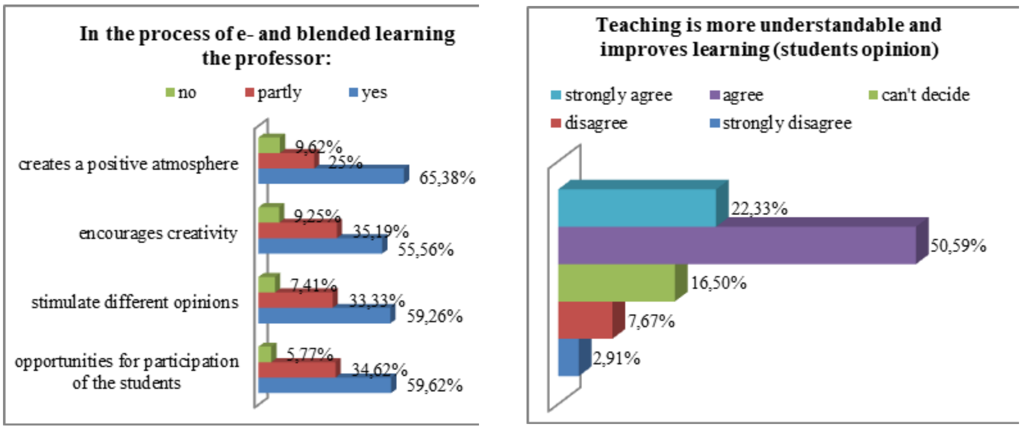

Figure 7. **New approach to the teaching and learning**

The results of the second survey shows that students emphasize the role of blended learning for a change in approach and method of teaching, using interactive methods and tools as a prerequisite for a more comprehensive and understandable content development, which increases the degree of students. Semantic data can be compared with the assessment of the style of teaching in a blended learning environment. Particular emphases in the answers in the first survey were placed on the creative and a positive atmosphere, stimulating creativity and free expression of different opinions, i.e. changes in the roles of both lecturer and students.

Conclusions

From the comparative analysis of longitudinal studies we can make the following conclusions:

Through Blended learning is made a fundamental redesign of approaches to teaching and learning. The changing roles of teachers and students, and created positive atmosphere stimulates creativity, autonomy and critical thinking, freedom of expression of own positions. The integration of teaching strategies with contemporary technology harmoniously combines traditional education with innovative application of information and communication technologies, in this way are created innovative practices and encourage student motivation. It develops the "*multiple intelligence*" of the students and makes them more competitive on the labour market.

Together with the development of the theory of e- and blended learning are designed practical models with specific scenarios and strategies for expanding the share of blended learning and implementation of online courses.

The majority of the students surveyed perceived the blended learning as an innovative approach that makes the higher education more attractive, more comfortable and more efficient.

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Cognitive Effects of Educational Software on Children's Learning

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Abstract

The article describes some of the instructional advantages of the software applications by reference to the most active learning principles. Active learning is known, in terms of applied teaching theory, as an explorative approach which allows the use of errors and progress phases in outcomes achieving. Digital learning allows an immersive experience through exploration of phenomena, relationships, changing parameters/entering variables in a continuous dynamic of reconstruction. As an example, the paper presents the results of an experimental research, measuring the cognitive impact of using software on children's competences. The study was conducted through identical assessment tests in initial, formative and final stages, applied on experimental and control groups. Study will sustain some evidences of the advantages of using software applications, in particular on the development of children's mathematical skills. However, learning success is conditioned by an optimal instructional design of software based on active learning principles: learning through trial and error, and constructivist learning.

Keywords: instructional design, active learning, educational software.

1. Learning trends

Designing a learning activity with the support of educational software combines technical expertise, applied learning theories and knowledge in curricular areas.

<u>Educational software</u> content is connected to national curriculum, but has a lot of differentiated alternatives perfect adapted to the children's needs. For example, it can distribute various assessment tests on the same theme; it can design individual progress through a structured learning material or provide collaborative learning plans.

1. Educational software enhances learning by trial and error

Active learning is known, in terms of applied teaching theory, as an explorative approach which allows the use of errors and progress stages in outcomes achieving. Different from the traditional concept, which interprets the error as a frustrating penalty, a new instructional management sustains a positive role of error. New concepts such as *error training* become part of an active learning process, with an important role on teachers` feedback. This makes it possible to explore creative solutions by using "risky" strategies, in digital format, with the possibility to reconfigure data and prevents premature ideas. Another advantage is given by the lack of a formal guiding in learning activities.

Complete configurations of learning tasks are oriented to three types of objectives:

- Performance - as a result of the absence of error;
- Efficient error recovery;
- Improved learning by error, in order to reduce the errors in the future.

In order to implement these aims, the instructional design of digital applications must apply the principles of progressive learning, by passing sequentially from the particular to the general, from simple to complex, from concrete to abstract, from cause to effect, from the familiar the unfamiliar.

1. *Educational software provides a diverse representation of scholar knowledge*

Students benefits from the opportunities offered by the multiple representations of knowledge, making effective connections between internal and external knowledge processes. The strengths on the construction of knowledge through digital applications are sustained by these arguments: the representations in the virtual environment are dynamic; new technologies transform ideas into "*matter",* and allow preservation of activities, and products; digital applications have an adaptive potential, using a real advantage given by signaling through alerts (an immediate feedback), offering alternatives for individualized learning and differentiated instruction. Besides, using digital resources can replace also many access difficulties: high-cost, high-risk, historical/spatial impossibility or some technical reasons.

2. *Educational software encourage knowledge construction*

Digital applications allows an immersive experience through exploration of phenomena, processes, relationships, changing parameters/entering variables in a continuous dynamics of deconstruction and reconstruction. Teacher can apply constructivist approach in instructional practices in: a) an instrumental manner, oriented to the solving of concrete problems; b) an experiential manner, based on significant information for children's life; c) a methodological manner, motivated by the active learning strategies.

Digital tasks can provide rapid data access, in a multimodal format, which allows changes from measurements or comparisons to qualitative analyses and case studies; can show simulations and modeling by creating an exploratory environment; can offer small scale modeling, manipulation of three-dimensional objects, viewing the dynamics of the relationships between components; operation with elements (variables) that can modify their intrinsic qualities.

Using a specific educational soft, teacher can create an individualized learning project for children's profile.

Problem based learning and projects based learning are additional examples that can sustain a positive idea of socio-cognitive profit of e-learning. Research has shown that learning based on project/problem (a scientific activity where children also process information on a relevant topic for their life experience) is effective in students' motivation.

3. *Instructional requirements of digital resources*

In the process of developing learning resources, it is a complex instructional configuration comprising: clear instructions for achieving the learning outcomes, proposals for structured interactions in learning situations, sequential work, varied strategies and assessment tools, and concrete objectives reflected in learning outcomes.

We present below some of the requirements that an instructional designer should take into account in order to create a learning task:

A. Interface design	**B. Actions on learning objects**	**C. Linkage with the educational content**	**D. Learning activities**
1. Format of learning objects (audio-video or kinesthetic); 2. Different information sources – with entry point; 3. Dynamic and attractive design; 5. Configurations where learners can view their own activity.	1. Input actions – a debut in learning sequence; 2. Space in system answers/ pauses to give time for reflection; 3. Concrete representations of abstract ideas. 3. Time Management.	1. Links between form and representation - to facilitate information processing; 2. Dynamic images to support understanding of abstract representations; 3. Monitoring density (the number of information units to a sequence).	1. Open system of learning: recovery activities; updating; ramifications for different degrees of difficulty (differentiated instruction); 2. Variety of examples, problems and exercises.

Table 1. **Criteria in instructional design**

A teaching scenario includes the steps below, with a clear motivational component, like instructional events list promoted by R. Gagné:

- Establishing learning objectives;
- Feed-before, an initial motivation;
- Selection of topics of interest (feed-forward, motivation supporting);
- Personalizing learning style (learning rhythm, methods, type of intelligence, difficulty level, time scheme);
- Estimating of expected outcomes;
- Specifying actions (detailing learning activities; specifying ways of performing tasks);
- Performance evaluation;
- Valuing metacognitive competence, individualizing qualitative feedback.

3. The impact of educational software on the children's skills. An experimental study

Educational software is a program used in teaching, learning and assessment processes, providing opportunities both for collective and individual instruction. Educational software is an efficient tool that allows children to learn about the universe seasons, the world or daily life; can practice reading, writing, calculation, drawing or painting. Exercises are presented in an accessible way for children, easy to be processed by the visual system.

Most of educational software contains games. Children select an activity by clicking on one of the entry-points arranged on the computer screen. A frequent example of software that can be used in kindergarten is called *PitiClic*. This contains active games, which are challenging for children's curiosity and imagination. These are particularly important for improving cognitive performance in math, sciences, language education, etc. During activities, children are guided by a friendly voice: correct or incorrect answers are accompanied by messages of continuous encouragement or congratulation (Wrong! You should try again! Very good! You did!).

PitiClic was used in the present study by a kindergarten teacher, enrolled in First Grade Exam in their teaching career, under my supervision, at university, during 2014-2015.

1. *Research goal and objectives:* The purpose of this experimental study is to determine whether children's competences, and math skills, specifically, can be improved by using well-designed educational software. Specific objectives are:

- Assessing the efficiency of educational software in mathematics;
- Validation of learning conditions in order to facilitate new technologies use in kindergarten;
- Measuring children's progressive performances according to the specific competences written in national curriculum.

2. *Research hypothesis*: *If the teacher uses in their activity with children, different applications provided by educational software, in addition to conventional exercises, he will enhance cognitive results of his children*.

The experiment was conducted during a school year by an experimented teacher and included two pre-school groups, the experimental and control group, as medium-sized groups. Children included in the survey were between 4 and 5 years old and come from similar backgrounds, in terms of economic and cultural items.

3. *Data presentation, analysis and interpretation of research results.*

At the initial phase, teacher G.A. has designed an evaluation test, in order to measure the level of children's knowledge at the beginning of the experiment. After a short data analysis, tasks and recorded results were assigned, according to evaluation criteria.

Initial tests	***Experimental group***		***Control group***	
	Developed knowledge	Developing knowledge	Developed knowledge	Developing knowledge
1st test	55%	45%	60%	40%
2 nd test	65%	35%	70%	30%
Total	**60%**	**40%**	**65%**	**35%**

Table 1. **Initial tests results**

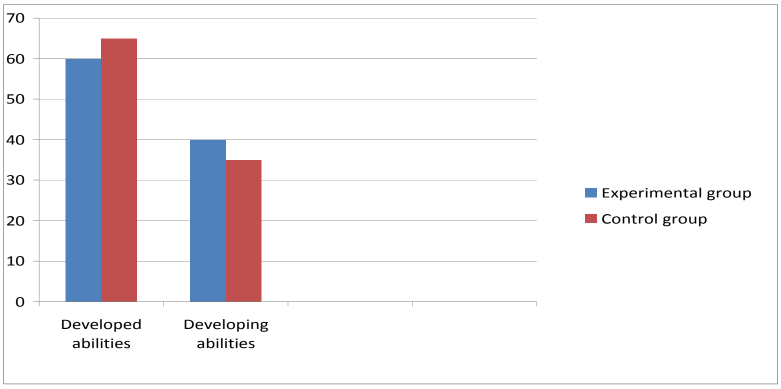

Figure 1. **Pre-experimental results**

In order to perform some tasks about criteria grouping of geometrical objects, teacher used daily conventional games and introduced as an independent variable, particular educational software based on math games. Determining the value of the dependent variables can make visible the impact of educational software.

1. *Educational soft – game example: Autumn Treasures*
Experiential domain: Science
Category of activity: Math
Purpose: forming groups of objects by size and color criteria;
Game elements: surprise, movement, applause, educational software.
Teaching methods: conversation, explanation, questioning, observation, demonstration.
Duration: 20-25 minutes.

2. *Conventional game*
Experiential domain: Science
Category of activity: Math
Purpose: developing children's knowledge about geometric attributes (shape, size, color);
Teaching methods: conversation, explanation, questioning, observation, demonstration, work in pairs, cube method.
Teaching materials: a bag, geometric pieces (circles, squares and triangles).
Duration: 20-25 minutes.

During this phase, after learning sessions, teacher applied formative tests, identical for both, experimental and control group, in order to verify the level of acquisitions.

Formative Tests	***Experimental group***		***Control group***	
	Developed knowledge	Developing knowledge	Developed knowledge	Developing knowledge
1 st test	75 %	25 %	70%	30%
2 nd test	70%	30 %	65%	35%
3 rd test	65 %	35 %	70%	30%

Table 2. **Formative tests results**

The results measured after the formative assessments are described below:

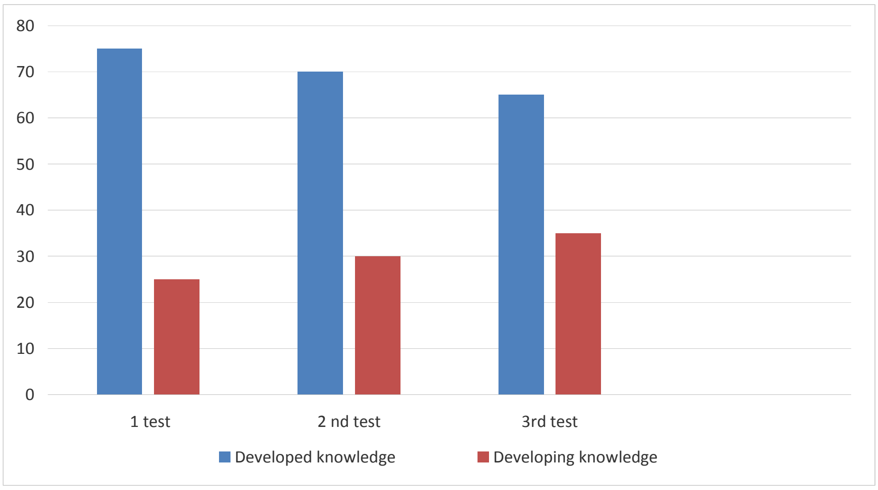

Figure 2. **Formative tests**

Throughout the experimentation period, teacher observed and recorded children's behaviors in the experimental group: *growing interest, active involvement in activities, positive attitudes with colleagues, autonomy in tasks.*

In post-experimental phase, goals are related to: the evolution process of the two groups, and comparing initial/in progress/final results.

At the final evaluation, teacher analyzed the results of the two groups and found differences between experimental and control group. Teaching with the support of games has positive effects. Children from experimental group increased the ability to describe numbers and figures, compared to their colleagues who have traditionally worked. They have enhanced the capacity to recognize, describe and group geometric shapes, and have developed more rapidly observation and recognition. However, in order to use educational software, children in the experimental groups have been previously acquired computer skills.

Final Tests	*Experimental group*		*Control group*	
	Developed knowledge	Developing knowledge	Developed knowledge	Developing knowledge
1 st test	90 %	10 %	80%	20%
2 nd test	85 %	15 %	75%	25%
Total	**87,5 %**	**12,5 %**	**75%**	**22, 5%**

Table 3. **Final tests results**

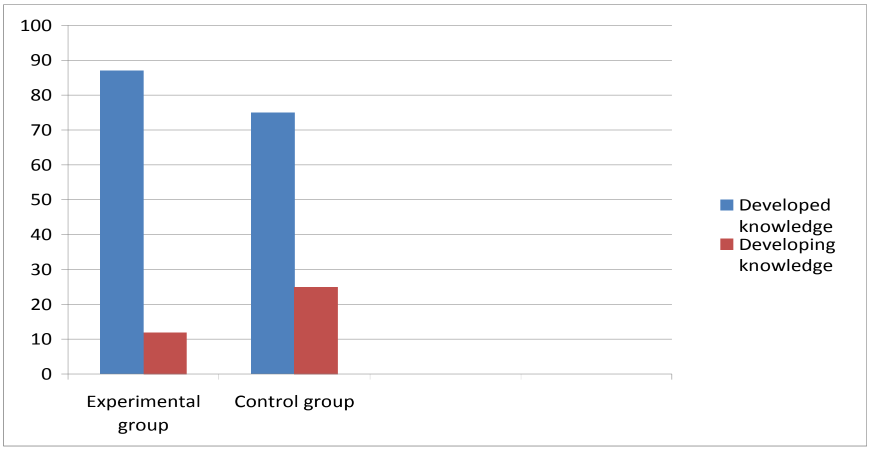

Figure 3. **Post-experimental results**

After the final evaluation, teacher analyzed the results and found clear proofs for the benefits of experimental groups. Because mathematical concepts were assimilated by children in a shorter time, the feedback regarding working with computer and using educational software was positive.

To benefit fully from the potential of educational software, it is necessary to assure a constant control of the time spent at the computer.

Preschool Teacher Training is a key element and, at the same time, a critical point in the initiatives of introducing ICT in kindergarten. It requires providing not only technical support for teachers, but also a practical guiding in order to explore the entire potential of new technologies. *As a conclusion, computer activities are complementary, not substitutive for conventional learning forms.*

Acknowledgment: Gratitude addressed to the preschool teacher who made an appreciable effort for this action-research, presenting valuable data for these scientific purposes, but also for her daily succes in different learning activity with educational soft.

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The Use of the MuseScore Software in Musical E-Learning

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Abstract

Our research stemmed from the dire need of our students from Pedagogy of Primary and Preschool Teaching specialty, in their roles of future teachers and educators, for a virtual learning medium to ensure the optimal means possible in their creation of activities used within musical education. Initially, our research led us to the Open Source Options for Education website, and toward the systematic approach proposed by Mark Johnson. This allowed us to identify the most relevant music softwares, and, especially, to come across MuseScore, a musical recording and editing software. Its user friendly interface, free downloading option and the fact that it can be accessed in multiple languages – Romanian included – led us to its inclusion within the study. The objectives of the research are to investigate how the MuseScore software contributes to: 1) the consolidation of previously learned music theory concepts; 2) the improvement of musical score reading; 3) the facilitation of designing integrated teaching activities, by combining the information and communication technologies. With these objectives in mind, we have used the MuseScore software within the first semester of the academic year 2014-2015 in Music Education and Method and Practice of Music Teaching classes. The activities carried out during the 14 weeks of the study have demonstrated that MuseScore is an extremely useful tool in designing activities for music education, and, moreover, it is a means by which students find it easy and enjoy musical writing and reading.

Keywords: music recording and editing software, information and communication technologies, musical score editing, Pedagogy of Primary Teaching.

1. Introduction

Within the Babeş-Bolyai University from Cluj-Napoca, the Faculty of Psychology and Education Sciences offers an undergraduate program in the Pedagogy of Primary and Preschool Teaching – a three year program, available both in the form of regular attendance and distance learning. The course entitled Musical Education. Music Teaching Methodology is present within those of the 5th semester. As the teacher of this course I have found that the vast majority of students do not have basic musical knowledge, they are lack the skills to read a music score and, moreover, they exhibit some sort of aversion towards writing and reading musical scores. Given these observations, as well as the fact that the subject is taught for only one semester, I have reached the conclusion that the most appropriate method in making the sudents develop the skills needed for this course was to combine traditional teaching methods with E-learning.

The systematic approach to musical softwares taken by Mark Johnson on the Open Source Options for Education website has led us to select the MuseScore program, which was described in the following manner in the Real World Use column: „MuseScore is used internationally by schools, universities and private music teachers at all levels, including by Redbridge College and De Montfort University in the UK." (http://oss-watch.ac.uk/resources/ossoptionseducation). The statement is based on several answers that were given to the question "Anyone using MuseScore for Education?" launched by the author on the 2nd of January 2013. Out of the variety of answers given by the users, we found the following one relevant for our study: „I'm a full-time music teacher and musician from the island of Puerto Rico. Musescore is the only music notation program I use at the moment (previously used Finale and then Sibelius before switching to Musescore), both for educational and personal work. Since promoting Free/Libre and Open Source Software (FLOSS) is part of my teaching philosophy, I teach how to use Musescore in a basic level to my elementary school students as part of the music class. (...) Best of all, my students get to install a copy of the software at their home computers. That way they can keep practising what they learned at the music class". (https://musescore.org/en/node/19561).

By including the MuseScore software in our study, we sought out to investigate its contribution to: 1) the consolidation of previously learned music theory concepts; 2) the improvement of musical score reading; 3) the facilitation of designing integrated teaching activities, by combining information and communication technologies.

2. Research Metodology

2.1. Research Subjects

This research was applied to the third year students within the Pedagogy of Primary and Preschool Teaching specialty, German line, at the Sibiu location of the Faculty of Psychology and Educational Sciences of the University of Babeş-Bolyai of Cluj-Napoca. Since the year was made up of merely 10 students (of which 3 were absent in the semester due to them having left to Germany on scholarships), the research did not use sampling, but worked with the entire class. The experimental group was made up for students who were already practicing – 3 elementary school teachers and 4 kindergarten teachers –, but who did not possess a basic knowledge of music theory and score reading. Bearing in mind the pedagogical experience of each participant, as well as the specific theoretical and musical requirements for both primary and kidergarten education, we resorted to dividing them up into two groups: Group 1, entitled School (3 students) and Group 2, Kindergarten (4 students). As the teacher, my involvement implied assuming both the role of researcher as well as being an active participant in the conduct of the study.

2.2. Research Procedure

The research was conducted in the first semester of the 2014-2015 university year, between October and February. The activities were organized in time-slots of 3 hours per week (2 hour lectures and one hour seminar), for a total of 14 weeks. The language of instruction was Romanian. In order to achieve the set out objectives, the experiment was conducted in four stages.

Stage 1. Initial questioning. At the beginning of the semester, during the first Musical Education; the Methodology of Music Teaching class, we have distributed a short questionnaire to determine their level in terms of theoretical and interpretive music skills. The questions asked were: Do you know the musical notes by name? Are you able to read the notes on the staff? Are you familiar with note values and their duration? Are you able to sing a song from reading a score? Do you sing/play an instrument? Do you like to sing?

The answers (ranging from "yes" to "somewhat" and "no"), were noted in an attendance catalogue. By these questions and answers we sought to find out the initial level of training of each student and to identify what the individual needs of each student is, in order to take these into account during the courses and seminars, as well as to evaluate the progress of each person during the exam at the end of the semester. Moreover, we have sought to determine what is the general level of musical training of this experimental group.

Stage 2. Initiation into Music Writing and Reading. The initiation into reading and writing music, as well as into vocal interpretation was done for a total of 4 weeks, using traditional teaching methods. This stage was based on systematic observation, the data collected being noted on an Observation Sheet. The objectives were:

- to easily identify the graphic signs which stand for the caracteristics of muscial sounds: pitch, duration, intensity;
- to name and graphically reproduce the elements of notes pertaining to the pitch (staff, notes, clef, alterations);
- to graphically reproduce correctly the note durations and related rests: whole notes, half notes, quarter notes, eighth notes, sixteenth notes, dotted half notes, dotted quarter notes, dotted eighth notes;
- to create short rhythmic segments;
- to identify the graphic signs pertaining to the pitch, duration and intensity of musical notes within children's songs;
- to sing children's songs.

Stage 3. Consolidating the theoretical and musical notions through MureScore. The MuseScore software was used to consolidate previously learned music theory notions and related skills, for a duration of 6 weeks. Firstly, the initiation into the use of the program was conducted. The 2.0 version of the software was used, which allows for the selection of a variety of languages, including Romanian and German. Due to the fact that the software is free (https://musescore.org/ro), it was directly installed on the German line's own laptops, the students being able to also directly download it on their own laptops or personal computers. Consequently, reading and writing music could be practiced both as a group at class as well as individually (at home).

From the variety of editing options available in the software, only the basic ones had to be learned: the introduction of the song's title and composer; the selection of the needed musical instruments; the selection of the number of measure bars needed; the selection of time signatures, clefs and key signatures; the introduction of note duration and rests; the introduction of notes; the introduction of accidentals; the introduction of the tempo; the introduction of text; audio playback of the edited piece; exporting the file in audio and image file form.

The degree of improvement concerning musical writing and reading through the MuseScore software was first systematically observed and noted on the Observation Sheet, after which the content analysis of the 6 written musical scores and their related audio files were conducted. The original sheet music was used as control instruments within this analysis. Music writing began with two songs in German, which were previously known and chosen by the participants themselves, one for each group: "Die tante aus Marokko" (Group 1, School) and "Der Kuckuck und der Esel" (Group 2, Kindergarten). Later, they were given 4 unknown songs for them to introduce into the program and write using MuseScore. By writing a new song every week, the aim was to consolidate previously known theoretical concepts, as well as singing with the help of the software's audio playback device.

Stage 4. The development of integrated activities based on E-learning. The last 4 weeks of the study were dedicated to the use of the MuseScore program in developing the students' abilities to design integrated teaching activities, in which music will be the main element in developing specific competencies needed for Music Education and other courses. E-learning was introduced in this last stage of the study: web sources, mobile phones, Microsoft PowerPoint Presentations. The initial idea was that of creating an integrated activity the theme of which was the city of Sibiu. For the musical aspect of the project two already known German songs were chosen ("Die tante aus Marokko" and "Der Kuckuck und der Esel"), while for the Romanian language, history and natural sciences fields a certain text was selected concerning the city of Sibiu, taken from Wikipedia. This information had to be versified by each group, taking into account the existing melodic line and the specific characteristics of each group: school or kindergarten. A series of images and drawings were selected from the web in conformity with the lyrics, while, in parallel, each student was asked to record sounds from the environment, suggestive sounds concerning the images and versified lyrics, using their mobile phones. At the end, all these were integrated by each group in a PowerPoint Presentation. By creating this presentations, the intention was to evaluate the effectiveness of the MuseScore software in facilitating the creation of integrated activities, by combining information and communication technologies.

3. Results

As a result of the study 6 musical scores were edited using the MuseScore software, alongside 2 other PowerPoint presentations, in which the following elements were integrated:

- 2 scores typed in the MuseScore program;
- 2 audio-instrumental tracks edited in the MuseScore program;
- 2 versified lyrics created according to the information provided regarding Sibiu, initially taken from web sources;
- 5 audio recordings of nature sounds, recorded with mobile phones;
- 33 images and drawings selected from web sources, that are representative for the vity of Sibiu.

The first PowerPoint presentation, created by Group 1. School, was entitled “Walking through Sibiu” and was composed by a total of 8 slides that featured 18 images, a music score typed in MuseScore, 2 audio-instrumental recordings of the edited piece and 3 audio recordings of nature sounds. The first slide contains information regarding Group 1: last names, first names, year, the title of the presentation and the audio-instrumental recording of the “Die tante aus Marokko” song, written in MuseScore. The second slide consists of two sentences regarding the geographical location of Sibiu and two images of the map of Romania (with Transylvania being highlighted) and that of Sibiu. The third slide comprises 3 paragraphs about the environment, 4 images (the airport, Păltiniş Resort and Lake Bâlea) and an audio recording of sounds from the airport. 3 images were integrated into the 4th slide, alongside a paragraph about the climate, flora and fauna, as well as a recording of bird sounds (Figure 1). The next slide includes information about Ocna Sibiului, 2 characteristic images of this region, and an audio recording of the sounds of water. Slide 7 describes in a few short phrases the ethnic groups that live in the county, groups that are shown using 4 images. The last slide contains a music score created in the MuseScore software and the audio-instrumental rendition of it (Figure 2).

Fig. 1. **Slide no. 3 – images, audio recording and information concerning the environment**

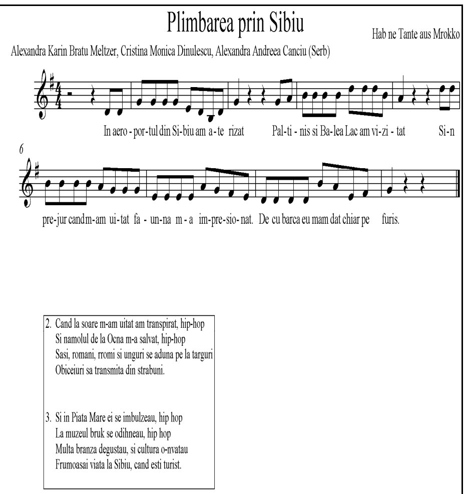

Fig. 2. **Slide no. 8 – the musical score created using MuseScore**

The second PowerPoint presentation, created by Group 2. Kindergarten, was composed of 6 slides. The first 5 slides were made from images and drawings fit together to fill the whole slide, as a background. On the bottom of the first slide the names of the students of Group 2 were put, while there was a drawing integrated as a background above it, having a text box with Sibiu's name in Romanian, German and Hungarian, a drawing showing two children and an audio recording of the German song "Der Kuckuck und der Esel" written in MuseScore. The second slide showed an image with the Large Square of Sibiu, in which the title of the presentation "The city of Sibiu is ..." was integrated. The 3rd slide was made up of 4 drawings, joined together as a puzzle depicting the winter, in which other 2 audio recordings of ambient sounds were also integrated. The next slide had the same background image as the first in which there were 3 text boxes with the names of the 3 ethnic communities living together – Romanians, Saxons, Hungarians – , as well as a drawing showing 3 children in colorful outfits (yellow, green, blue and red). Also, the 6 images from slide 5 were integrated on the same background, images concerning to the cultural and artistic aspects of the city (Figure 3). The last slide was made up of the score written using the MuseScore program and the instrumental audio recording of the same song (Figure 4).

Fig. 3. **Slide no. 5 – pictures and drawings concerning culture and the arts**

Fig. 4. **Slide no. 6 – the music score created using MuseScore**

4. Discussion and Conclusions

Analysis of the questionnaire responses. After conducting the questionnaire in Stage 1, we received confirmation over the fact that the students did not have a minimal knowledge of music theory, they cannot sing a song reading the score, and, moreover, they exhibit, for the most part, a certain aversion toward reading and writing music.

Analysis of effectiveness with using the MuseScore software. The fact that music theory teaching was commenced starting with the basics was a very good decision. Based on the Observation Sheet, however, it became evident that teaching music theory would not have been sufficient to have all students read music from a score in the span of a single semester. The editing page of the software was design in a way that it allows for the visualization of both the graphic signs as well as their respective names, thereby consolidating the notions of music theory (Figure 5).

The benefits of the program during the stages of learning musical notation was also noticed by composer and pianist Karolis Biveinis, who made the following comment: „I use MuseScore at my work with assignature "New Technologies" where we are working with students at music notation.

It's in Tui (Spain), Professional Conservatory of Music. It is a great tool for music notation!" (https://musescore.org/node/19561).

The initiation into learning how to use the music writing MuseScore 2.0 software by way of 2 already known songs ("Die tante aus Marokko" and "Der Kuckuck und der Esel") has facilitated the process. On the other hand, listening to the songs edited in the program have shown that the way the students knew the songs varied from the manner in which the original score was written. This frequently occurs when songs are learned "by ear" – each person reproducing the song as they feel they have heard it. However, by editing the songs in the MuseScore program, any variation is eliminated. The choice of already familiar songs, which they gladly sing, as well as their division into two separate groups have proven to be effective in creating a relaxed work environment and eliminating prior reservations concerning music writing and reading.

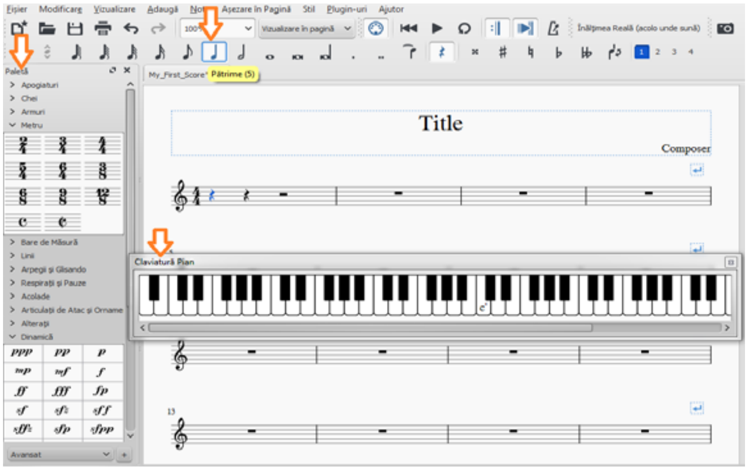

Fig. 5. **A MuseScore editing page**

In music, solfege, or score reading, in a matter of prime importance. If this ability is not formed, no new songs can be learned, which means that in just a short amount of time, the Musical Education activities in the classroom will become repetitive and uninteresting, since they only make use of songs that are already familiar to all. The audio playback option of the MuseScore software allows for the learning of any song by listening to its melodic line. Thus, the students could listen to the song both played back after they have written it using the program, as well as later on, as an Mp3 file. The possibility to play back the written song and, especially, to listen to it in shorter fragments and solfege it alongside the playback has made it that in a relatively short time period our students were able to solfege all the written songs.

The content analysis on the PowerPoint presentations "Walk in Sibiu" and "The city of Sibiu is ..." was based on 4 criteria:

1) *Editing the songs.* The MuseScore program was effectively used in audio and instrumental editing of the songs "Die tante aus Marokko" and "Der Kuckuck und der Esel". The songs were correctly introduced into the program, in accordance with the original score.
2) *The versification of information.* Both texts put to verse rhymed and were a logical formulation of ideas. The text versification included relevant information for the subjects of history and natural sciences. The lyrics of the first presentation, however, were not created according to the music versification, therefore, it could not be sung to music.
3) *The image-sound corrensponce.* Recording ambient sounds using one's mobile phone – instead of merely downloading sounds from the internet – was chosen precisely to make

students aware of the sounds and noises of the environment in wihch they are living. The recorded sounds were properly associated with the images and drawings featured in the presentations. The school presentation contained more relevant sounds, while only 2 unidentifiable recordings were included in the kindergarten presentation, whereas, the importance of environmental sound perception is an important element within preschool musical education.

4) *The effectiveness of combining imformation and communication technologies.* Retrieving information about Sibiu from web sources (images and text), putting it into verse as well as transfering them on musical notes using the MuseScore software, also, using a mobile phone to record environmental sounds have all revealed the fact that information in any field can more easily be retained through music. Two songs were composed with the help of the MuseScore software ("Walking in Sibiu" and "The city of Sibiu is ..."), songs which helped create integrated type activities: music, language and communication, history, natural sciences.

The experiment demonstrated that using the MuseScore software has significantly contributed to the consolidation of theoretical and musical notions, to the improvement of musical score reading as well as to the facilitation of designing integrated teaching activities, by combining information and communication technologies..

As a result of the experiment and the correspondence carried out with via e-mail with Thomas Bonte, the co-founder of the MuseScore software, we have managed to put Babeş-Bolyai University on the map of higher education institutions that use the program within their curricula. (https://musescore.org/en/about/schools-universities-using-musescore).

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New Media (un)literacy of employees in Serbian Education

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Abstract

This paper examines new media literacy of employees in Serbian education, in terms of the profession and field of education. The survey was conducted in 2013 on 172 respondents - employees in education: teachers and teacher assistant at universities and teachers in secondary schools. Descriptive analysis has shown that the total score in the whole sample media literacy is 3.29, which indicates partially expressed new media literacy, a multivariate analysis provided the result that there are significant multivariate effects of profession and the field of education the components of new media literacy.

Keywords: new media literacy, education, employees in education, competences.

1 Introduction

In terms of increased computerization and digitization, education must transform itself. As argued by Henry Jenkins, a well-known media theorist, education in the future belongs to the new media. Education should therefore recognize and strengthen knowledge and skills required for the competitive usage of new, multimedia and use them as a resource for further development. Thus, competences of employees in education, especially teachers' competences, have become essential for the improvement and modernization of the educational process. New area of research and development has emerged: definition and measurement of multimedia literacy in an educational context.

Authors' previous study have shown that there was a high degree of digital participation of high school pupils and university students in Serbia, who are prone to digital and technological innovations and have mastered new technologies for media consumption, communication and interaction (Andevski, Arsenijević, 2013). This research confirms previously established observation that young, often called digital natives, are born with and totally adapted to new media and technology. Education are facing new requirements and challenges to adapt the process of learning to new trends in technology, to break down barriers separating digital natives and digital immigrants. Therefore, as the role of new media and the gap between these generations are increasing, the importance of research toward new media competence in education is gaining ever more importance.

The research presented in this paper represents a guideline for the development of new media literacy in the education in Serbia. The results should be relevant for the leaders in education, educational policy creators, for educational practitioners and theorists, as well as all for all of them who are interested in education. The results of this study are very indicative in terms of modernity and adaptability of the teaching staff in Serbian secondary and higher education, for the global multimedia and technological changes.

2 New Media Literacy

Ongoing discussions on the new literacy puts the media literacy (in a context of critical assessment of media content) as basis, and as a supplement to new forms of literacy the note of multimedia, digital, or new-media are added. In conditions when concepts of literacy is constantly being examined and its standards raising; the functional, technology, information and media literacy are merging. Therefore, digital literacy, often referred to multimedia literacy, should include both critical thinking and technical competence (Martin and Grudziecki, 2006: 254).

The concepts of new media literacy and participatory culture (2006) have been established the Jenkins (2006), who describes participatory culture as participation on the internet supported with Web 2.0 technology. This participation, in relation to the previous Internet usage supported with Web 1.0 technology, is characterized by interactivity and feedback versus unilateralism; content production versus its consumption; active and exploratory doing versus passive one; as well as by civic and social responsibility versus personal interests. Active users and participants of participatory culture should possess multimedia competencies and new media literacy. Jenkins has defined new media literacy (in further text: NML) as a concept that includes social skills needed for collaboration and networking. These skills include "the basis of traditional literacy, research skills, technical competence and critical thinking" (Jenkins, 2006: 4).

Furthermore, Jenkins has operationalized NML through the following competencies for successful participation in the contemporary media processes: *Play*: ability of solving problems through play with experiment and strategy, *Performance*: ability to take alternative identities with the aim of improvisation and discovery, *Simulation*: ability to construct, apply and analyze dynamic models of real processes, *Appropriation*: ability to reuse media contents on creative way, *Multitasking*: ability to globally understand the environment and to focus on certain details when needed, *Collective Intelligence*: ability to create collective knowledge in order to achieve common goal, *Judgment*: ability to judge credibility and ethical value of media contents, *Transmedia Navigation*: ability to multimedia follow narrative worlds over media limits of the system, *Networking*: ability to search, analyze and publish information and knowledge by the use of network, *Negotiation*: ability to understand different social systems of values and to adjust to alternative norms, *Distributed Cognition*: ability to meaningfully interact with tools for enlarging intellectual capacity and *Visualization*: ability to create and understand visual presentation of information. According to Jenkins, the primary goal of the 21st century schools is to develop media competences by the use of adequate pedagogical methods.

3 Methodology

The data was obtained from 172 examinees – employees in education: from high school teachers, college lecturers and professors, assistant lecturers at faculties, assistant professor, associate professor and full professor. There were more women than men among examinees (59% female and 34.3% male), aged 23 to 64 (M=41.81, SD=10.26).

Table 1. **Share of examinees by groups of profession and field of education**

		Profession			
		High school Teacher	Assistant lecturer at university	University Professor	Total
Field of education	Social & Humanistic	25	41	31	97
	Natural & Technology	25	17	33	75
Total		50	58	64	172

The research was carried out in Serbia in 2013. The research objectives were to determine the level of respondents' NML in relation to their profession and field of education and to determine if there are effects of respondents' profession and field of education on the expression of NML.

The instrument used for the survey had been created by Literat (2011), which has been adjusted for Serbian sample and modified improving its validity and reliability with the permission of the author (interventions are presented in the paper Arsenijević, Andevski, 2013). The questionnaire contains 60 questions with a Likert type scale response of 1 to 5. Scores for the dimension of NML is interpreted as follows: 1-1.5 - very low expressed, 1.5-2.5 - low expressed, 2.5-3.5 - partly expressed, 3.5-4.5 - highly expressed, 4.5-5 - very highly expressed. The analysis of main components is used with the aim of testing the validity of the questionnaire. In the final solution, 57.85% of the total variance was explained with 10 retained factors. Ten isolated factors correlated to twelve Jenkins's competences of media literacy that forms a theoretical frame of this study: *Performance and Simulation*, *Judgment, Negotiation, Multitasking, Transmedia Navigation, Appropriation, Visualization, Play, Collective Intelligence* and *Distributed Cognition*. The questionnaire has a high reliability: .91. Cronbach's alpha coefficients of individual components are from .65 to .84.

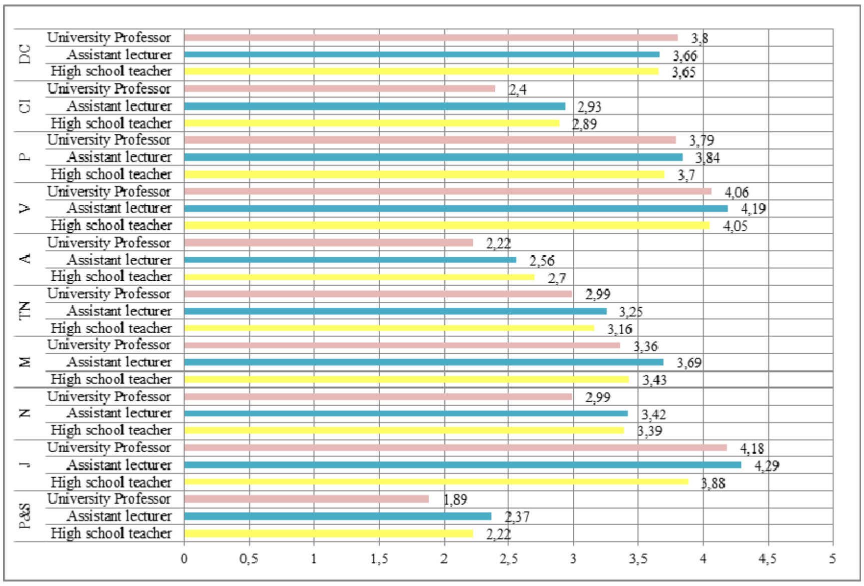
4 Results

4.1 Descriptive analysis for the components of multimedia literacy

Table 2. **Respondents' scores on NML**

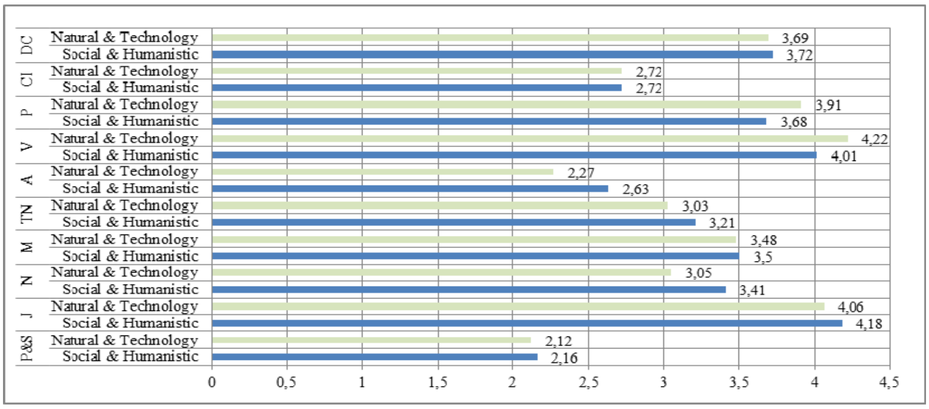
NML components	Arithmetic Mean	Standard Deviation
Performance and Simulation (P&S)	2.15	0.77
Judgment (J)	4.13	0.67
Negotiation (N)	3.25	0.94
Multitasking (M)	3.49	0.85
Transmedia Navigation (TN)	3.13	0.88
Appropriation (A)	2.48	1.01
Visualization (V)	4.10	0.84
Play (P)	3.78	0.77
Collective Intelligence (CI)	2.72	1.17
Distributed Cognition (DC)	3.71	0.94
NML average	**3.29**	**0.88**

Table 2 indicates that the NML score of the sample is 3.29, which represents partially expressed NML. Respondents of this research have mainly developed competencies: *Visualization* (with an average score of 4.10), *Judgment* (4.13) and *Play* (3.78), while the least developed are: *Appropriation* (2.48) and *Performance and Simulation* (2.15).



Graph 1 shows that assistant lecturers at universities achieve the highest scores for most of the components (except in the case of *Appropriation* and *Distributed Cognition*), so their scores for the NML in

general is 3.42; while high school teacher have lower score (3.31) and teachers in colleges lowest (3.17). However, previous research (Arsenijević, Andevski, forthcoming) indicates that there are significant correlations between age and NML, and also there are significant age differences between respondents with different professions (F (2,168)=27.39, p=,000). Therefore, relations between the groups regarding their NML are studied with detailed statistical analysis in following chapter.



Graph 2. Respondents' scores on multimedia literacy in relation to their field of education

Graph 2 shows that the respondents of social-humanistic orientation achieved higher scores on the components of NML than those with natural-technology expertise, except in the case of the *Visualization* and *Play* (with the component *Collective Intelligence* scores are the same for both groups).

4.2 The effects of profession and field of education on NML components

In order to test the effect of profession and field of education on NML components, multivariate analysis of covariance has been applied. The age in the analysis has been kept under statistical control (it was introduced as covariates), so as the effect of occupation would not be influenced by age.

Table 3. **Multivariate effects of predictors on multimedia literacy components**

Effect	Wilks' Lambda	*F*	df_1	df_2	*p*
age	.85	2.70	10	155	.004
profession	.78	2.04	20	310	.006
field of education	.80	3.87	10	155	.000
profession x field of education	.89	0.95	20	310	.525

There are significant multivariate effects of profession and field of education, while their interaction was not significant). There is a significant multivariate effect of age, but it will not be analyzed because the age was introduced with the aim to control other effects.

Table 4. **Univariate effects of predictors on multimedia literacy components (df_2=164)**

Effect	Multimedia literacy components	df_1	*F*	*p*
Profession	Performance and simulation	2	4.59	.011
	Judgment	2	4.95	.008
	Negotiation	2	1.41	.246
	Multitasking	2	0.28	.755
	Transmedia Navigation	2	0.09	.913
	Appropriation	2	3.46	.034

	Visualization	2	0.40	.673
	Play	2	0.54	.582
	Collective Intelligence	2	1.87	.157
	Distributed Cognition	2	0.80	.451
Field of education	Performance and simulation	1	0.22	.644
	Judgment	1	0.38	.540
	Negotiation	1	4.25	.041
	Multitasking	1	0.24	.626
	Transmedia Navigation	1	1.18	.279
	Appropriation	1	4.58	.034
	Visualization	1	3.84	.052
	Play	1	5.29	.023
	Collective Intelligence	1	0.47	.495
	Distributed Cognition	1	0.09	.759

The NML components on which significant effects have been achieved can be identified by examining the effects of univariate predictors (Table 4). Profession achieves significant effect on the competences *Performance and Simulation*, *Judgment* and *Appropriation*. In a case of *Performance and Simulation*, post hoc LSD test showed that university professors have lower scores compared to the other two groups, while high school teachers do not differ significantly from assistant lecturers at universities. Teachers in high schools have lower scores in Judgment in relation to the employees at the universities, and in the case of *Appropriation* they have higher scores comparing with university professors only, while they do not differ from assistant lecturers.

The field of education has effect on *Negotiation*, *Appropriation*, *Visualization* and *Play*. Respondents with socio-humanistic field of education achieve higher scores in *Negotiation* and *Appropriation*, and the respondents with natural-technology orientation have better scores in *Visualization* and *Play*.

5 Discussion and Conclusion

Descriptive statistics show that the NML score of the whole sample is 3.29 and that it represents NML partially expressed. The respondents' most pronounced competences are *Visualization* (with an average score of 4.10), *Judgment* (4.13) and *Play* (3.78), while the least are *Appropriation* (2.48) and *Performance and Simulation* (2.15).

As stated above, the research instrument explores both technology and media competences, and social and research competences needed for the use of new media. Therefore, higher scores for specific components (*Judgment, Visualization* and *Play*) could be explained with the respondents' tendency to compensate these skills through the social and exploratory abilities. *Judgment*, as the ability of critical and objective examination of media content, is the competence that could be developed by individuals who do not use new media, as well. *Visualization*, as a comprehension and understanding of content through images, graphics and diagrams, could be developed through the consumption of printed media and watching television, as well as through the consumption of new media. *Play* reflects curiosity and a desire to examine and disassemble electronic devices in order to discover how do they work, and take the advantages of computer games for gaining knowledge and experience.

Respondents' inadaptability to new media is more evident if analyzed less pronounced competencies, which are inseparable from the new media: *Performance and Simulation* (the score is 2.15) and *Appropriation* (2.48). The *Appropriation*, as the ability to reuse multimedia content, reflects the creativity, the ability to create something new by combining and updating, and meaningfully sampling and remixing media content.

New technologies allow everyone to participate in the creation and dissemination of Internet content. However, the respondents do not have pronounced the abilities of responsible, creative, social and critical evaluation, usage and reshaping of digital content, which are essential for multimedia literacy. The abundance of content and numerous Internet access do not guarantee the quality and creativity of its usage. That is why educational community's endeavor should be focused on Google-content's transformation in such a way that it evolves from the tools of information and entertainment, to the tools of education and critical, reflective thinking and creative expression. Information society will not be transformed into the knowledge society until consumers evolve from passive receiver of information, to the ones qualified to select, organize and use information in a creative and socially responsible manner.

Participants in this research have the lowest scores on the competence *Performance and Simulation* (2.15), which indicates the ability to adopt and explore alternative identities in online games and role playing, as well as the ability to model the real-world processes through new media, for the purpose of improvisation and discovery. This competence is operationalized by having an avatar in some online social interaction, by practicing games and simulation activities such as Second Life, SimCity, The Sims and following technology of simulation the reality in movies with computer animation (Lord of the Rings, Harry Potter, Avatar, etc.). This competence, supported with the possibilities new media offer, allows gaining perspective of the others, learning and dissemination of experience, obtaining experience that would be impossible or very difficult in reality. This competence's potential and necessity in secondary and higher education is extremely high. Moreover, it is known that an important reason for implementation of new media and technologies in education is to facilitate simulation, in order to make the process of learning and gaining experience easier and economical. Therefore, the finding that *Performance and Simulation* is low expressed among employees in secondary and higher education in Serbia, provides a clear picture of perspective of Serbian education in the direction of modernization of learning practice via new media.

The graphs show that assistant lecturers at universities achieve the highest scores in most of the components (except in *Appropriation* and *Distributed Cognition*), followed by teachers in secondary schools with somewhat lower scores, and university professors with the lowest. Moreover, respondents with socio-humanistic education achieved higher scores than those with natural-technology expertise on the multimedia literacy components, except in the case of *Visualization* and *Play* (with the component *Collective Intelligence* scores are equal for both groups).

Multivariate analysis of covariance, applied in order to test the effect of profession and field of education on NML components, show that there are significant multivariate effects of profession and field of education, while their interaction was not significant. The field of education has an effect on *Negotiation, Appropriation, Visualization* and *Play*. Respondents with socio-humanistic orientation achieve higher scores on *Negotiation* and *Appropriation*, while the one with natural-technology education are better in *Visualization* and *Play*. The component *Negotiation* reflects the respondents' ability to understand various value systems, the ability to participate in different communities, to discern and respect different perspectives, grasp and follow alternative norms. It is in the nature of the social-humanistic field in which respondents are educated, which is realized through the trust in others, openness to other cultures, the willingness for mutual cooperation and for better understanding people around the world. *Appropriation* focuses the need for re-using and combining multimedia content in a creative manner; it represents the skill of a meaningful acquisition, combination and modification of the work published by others to create their own artistic work (combining music, creating mosaic art, mounting video clips), the ability to create something new, which includes writing short stories, music remixes. Stacking of our respondents, members of the social sciences, humanities, with claims that in creative work allowed to take parts or motifs from existing works of art, it is important for young people to learn creative ways to use and combine motifs of different cultures, in order to become better known and more popular - also belongs to the very nature of social sciences, humanities, which, ultimately, overflowed in a digital alternative. On the other hand, respondents with natural-technology expertise achieve better results in *Visualization* and *Play*. Teachers in natural and technological areas are more inclined to experimentation skills, problem-solving strategies, closer to the view that the problem is viewed as a challenge, are more inclined to try out a variety of technical devices and the like.

The most significant and worrisome information provided by this research is that teachers in secondary and higher education in Serbia shows merely partially expressed new media literacy (3.29) in the digital era. The obtained results reflect the context of the social, cultural and economic circumstances of the society in which the research was conducted. They suggest that the teachers in Serbian secondary and higher education that have participated in the research are not adapted to the modern society that belongs to the new media and that their technological and media competence are not developed in accordance with the new requirements and challenges education is facing. The results of this research match to those of empirical and theoretical research on media in education (Gone, 1998, Potter 2011), and indicates the necessity and importance of (multi)media literacy of young people and adults, and acquiring multimedia competences in order for better implementation of new media and technologies in education among developing countries.

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Duo or Multi Lingo

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Abstract

As a teacher of English for Specific Purposes (ESP), I have had to adapt my lessons to the purposes of my students majoring in various fields ranging from Psychology and Sociology, to Communication and International Relations. Hence, I have continuously looked for ways of combining the practice of general English with specialized vocabulary. However, not all my students have a good mastery of general English, which has sometimes made it difficult for me to introduce specialized lexical items. While trying to solve this problem, I have come across a crowd-sourced language-learning platform that was launched in 2012 and is completely free: Duolingo. My paper looks at Duolingo's strengths and limitations and tries to determine whether it should be used alongside other teaching methods in my ESP classroom.

Keywords: Duolingo, English for Specific Purposes, E-learning, mobile learning, foreign language learning.

1. Introduction

Duolingo is a Language-Learning platform that works both on mobile devices and on desktop/laptop computers. It is free of charge and it allows its approximately 100 million users worldwide to learn at their own pace and to practice all the macro-skills (reading, writing, listening and speaking). Duolingo provides the translation tools learners need so that they can understand and memorize the words that they encounter. As students progress, they earn skill points when lessons are completed or web content is translated.

Duolingo is a tool that enables learners to acquire or consolidate their knowledge of a

foreign language. I started doing research into its advantages and drawbacks in order to establish whether I could recommend it to my university students who are beginners or below intermediate level. As a teacher of English for Specific Purposes (ESP), my main aim is to combine the practice of general English with specialized vocabulary. However, my task is often made difficult by the fact that some students lack basic knowledge of grammatical structures or vocabulary. They are the ones that need to do some extra work and use Duolingo in order to develop their English-language skills.

2. How Does Duolingo Work?

New users first have to register, create a profile, and select the language they would like to study. Then, learners can take a placement test if they are not absolute beginners. Duolingo has levels, users get skill points as they progress from simpler exercises to more complex ones. Importantly, learners get instant feedback after each activity. At the end of each unit there is a revision section aimed at consolidating the knowledge and skills gained. The progress made by learners is shown using graphical representation. They also gain lingos which they can use later on for extra options.

Luis von Ahn, the creator of Duolingo, explicitly stated that the platform's goal is twofold: people learn a foreign language while being involved in translating the web. Moreover, von Ahn predicted in 2012 that if one million people participated on this platform, they could translate all the pages of English-language Wikipedia into Spanish in just 80 hours. He claimed that Duolingo is a computer system that allows massive collaboration for the benefit of humanity. At the same time, users are learning a new language - over 40 different language courses are offered across 23 languages.

On the one hand, Duolingo has learners translate web content and, because of people's ability to understand a language in context, humans are able to produce much better translations than computer software (such as Google Translate, for example). Thus, the computer provides one-to-one dictionary translations, and humans choose the one that best fits in the context. On the other hand, the application enables people to learn a foreign language during the process of translating predetermined sentences from a target language into their own.

3. Advantages

Duolingo is a crowd-sourced language-learning platform. It allows users to be independent (study by themselves), while at the same time it gives them the opportunity to interact with other learners from around the world. Hence, Duolingo also facilitates collaborative learning. The feature "Discuss sentence" gives participants the possibility to analyse correct and incorrect answers with other learners.

As I have already mentioned in the introductory section of this paper, Duolingo incorporates tasks that address all the four main skills necessary for the acquisition of a foreign language. Reading skills are practiced when users translate from target language into native language and/or vice-versa. Writing is also practiced while translating, but the software includes several dictation exercises as well. While translating content, beginners might produce nonsensical output, but von Ahn underlines that when reading and writing exercises are combined over a number of users, they eventually produce "output as good as professional translation" (2013: 2).

As far as listening skills are concerned, Duolingo asks learners to subtitle videos or to repeat what they have just heard. Speech recognition software, together with automated spellchecking, ensure accurate output. People have the option to repeat the recording or to play a slowed version before submitting their answers. Cook (2002: 5) proves that dictation is "effective in promoting confidence and accuracy" and that it "is a very authentic general learning strategy" (2002: 6).

Speaking exercises are limited to mere imitation of a sentence, yet users do produce content in the object language and a recognition algorithm determines whether the pronunciation is accurate enough for the student to pass to the next level. Thus, they do gradually improve and refine their speaking skills.

As learners climb the "skill tree", they acquire vocabulary and grammatical morphemes, and they improve their spelling and pronunciation. At this point it is important to underline the fact that learners have control over the pace with which they practice. They can skip a certain activity if they feel they have already mastered that theme. Later on they could redo the lessons they think they have not understood properly. Moreover, the software gives instant positive and negative feedback, which is extremely important especially at the beginning of one's path towards learning a foreign language.

As I have already mentioned, the majority of tasks are based on translations, and Luis von Ahn stresses that "the translations that learners do are not too hard, but still stretching" (2013: 2). He adds that "(i) users learn as well with Duolingo as with highly rated language learning software and (ii) they translate as well as professional translators, if the right sentence is given to the right person" (2013: 2). In effect, the application combines human ability in order to solve linguistic problems that computers are not yet able to solve. This is called "human computation", a phrase that von Ahn coined in 2005 (Garcia, 2013). At the same time, those who use the application increase their linguistic knowledge and manipulate language rules and patterns in a conscious manner. When learners are more advanced, they are encouraged to "immerse" themselves in the translation of "real articles from the Internet". The caption on the website mentions the fact that some sentences have already been translated by the Duolingo community, while others need to be translated from scratch or improved.

Garcia (2013: 20) points out that "Duolingo's design is pleasant, user friendly, neutral enough to be acceptable no matter which culture or which age". Those interested in registering need only provide a valid email address or a Facebook account. The software sends daily emails announcing it is time for practice, if learners choose that option. What is more, users can challenge their peers and this makes learning more motivating.

Vesselinov and Grego (2012) carried out a study meant to analyse the progress made on Duolingo by volunteer subjects who wanted to learn Spanish. Participants were asked to use the platform for 30 hours, and then take a standardized, multiple-choice test. The results took into account the time allotted to the study and the improvement made. The vast majority of the participants in the study liked working on Duolingo and most of them succeeded in improving their knowledge of Spanish. Vesselinov and Grego noted that: "The improvement was statistically significant and on average Duolingo users gained a little over 8 points of WebCAPE placement test per one hour of study" (2012: 19). Based on these findings they estimated that for a beginner it would take on average 26 to 49 hours of study with Duolingo to cover the material for the first college semester of Spanish.

After testing the application myself, I could say another advantage is the fact that one can learn a new language *and* practice a foreign language that they already know. I, for example, have used the software to study Italian, but I did not set my translations to Romanian (my native language), but to English. Duolingo, therefore, can become Multilingo as it allows users to juggle with three languages at one time.

4. Criticisms

It has been argued by supporters of communicative approaches to language teaching that translation exercises create a false equivalence between two languages and they impede fluent, real-life language use. Duolingo relies heavily on translations, but Cook (2002: 6) argues convincingly that translation is not an altogether obsolete pedagogical method. He demonstrates that in the real world we still need this skill while mediating between two or more languages in given social, personal, or business contexts. Cook concludes that, "for the majority of the world's population, switching and negotiating between languages is part and parcel of everyday language use" (2002: 6).

Another drawback might be the fact that Duolingo uses only a few types of exercises. Lessons are designed as mini-quizzes and practice becomes repetitive. Exercises include tasks such as: Translate the text (from and into the target language); Type what you hear; Mark all the correct translations; Identify the meaning of a vocabulary word (from several pairs); Translate the sentence by dragging words already provided (usually more words than needed for a correct version); Repeat text into the microphone. Some tasks use visual support through photos or videos. Repetition is useful in long-term language-acquisition, but it would be more fun to have other activities included in the application. Perhaps podcasts or links to other sites containing audio and video materials, alongside written text, could be added. From what I have seen in the "Comments" section, Duolingo's developers seem willing to take into account the insights provided by users, which can lead to an even friendlier and improved platform.

Krashen (2014: 14) criticizes language instruction based on conscious learning, claiming that it "does not produce true language competence". Subconscious language acquisition is said to be more effective even when comprehensible input (gains per unit of time) are considered.

5. How can I use it in my ESP classroom?

Duolingo can definitely be used as a supplementary way of learning and consolidating relevant vocabulary and grammatical structures. If my students who are below intermediate level practiced regularly on Duolingo, then it would be easier for me to add longer articles, different types of exercises, and more specialized vocabulary in my ESP class.

It could be particularly useful for distance learners, but those who attend classes weekly could also stay in touch with the language while away from school. By setting daily goals learners can stay motivated. Obviously, by practising daily everyone makes progress. If learners access schools.duolingo.com, they can share progress with their class. This option gives the teacher if not control over the students' practice, at least an idea if the student has done any work at all.

Although not perfect, the software works well (both on mobile devices and on computers) and it is an appropriate aid to the language teacher. Students are required to translate online texts, and translations compel them to use structures they might otherwise avoid, to look up words in dictionaries, to practice spelling and idiomatic expressions in various contexts.

In fact, Duolingo facilitates the creation of a community of practice. The fact that students interact with other users and comparing their experiences adds a new dimension to the traditional ways of teaching/learning a language. Working with Duolingo involves a conscious effort which results in the development of English-language skills.

What advantages does this software have over its competitors? Duolingo offers more languages than Busuu, for instance. Other sites (such as Babbel) have some sections that require membership. Mango Languages has to be paid. Memrise uses only flashcards, thus narrowing the language-learning. Last but not least, Duolingo has around 100 million users and it was selected by TechCrunch as Best Education Startup and application of the year 2013 for iPhone and Android.

6. Conclusions

A prominent feature of Web 2.0 is the fact that users can generate content. The Duolingo staff has established and Upload Centre for those who wish to provide documents for translation. Simultaneously, people who are willing to practice their knowledge of a foreign language access Duolingo, view the original document, and provide these translations. Other learners then vote which is the best translation, or suggest edits for those parts that are unsuitable. In this way, the quality of the texts produced by learners comes close to that produced by professional translators.

To conclude, I think Duolingo is a valuable tool that can be used by language teachers as additional practice to the work being done in the classroom. In other words, the traditional language classroom needs to open up more and more to online resources, and Duolingo is an appropriate software to do that.

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Virtual environment – a cartographic documentation tool for the students in Geography

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Abstract

Map is essential for the students in Geography, and in the context of E-learning 2.0 and Web 2.0 online maps are easy to access wherever there is a computer connected to the Internet. This research focuses on two questions: (1) How the students in Geography document themselves on the Internet (during their formal and informal activities)? and (2) How can the teacher influence the cartographic documentation in virtual environment?The authors applied a questionnaire that focused on a number of issues, of which we mention: the situations when the students use the online maps for documentation or virtual learning; the kind of cartography sites they access and the maps they prefer; the extent to which they use the WMS/WCS/WFS services; the type of cartographic sources considered useful for accomplishing their homeworks; the frequency with which they use the online maps for learning; the elements they check before using a map; their behavior when confronted with online maps containing errors; and the purpose for which they have used so far the cartography sites.

Keywords: online cartographic documentation, online learning

1. Introduction

Unlike a few years ago when one could "seldom find in a (...) normal library" a computer connected to an online catalogue able to identify the libraries in the world having in their collections a certain publication (Eco, 2000:67-68), nowadays people can document themselves on the Internet almost anywhere. For geography specialists documentation refers to texts, statistical data, pictures, but mostly maps. The geographers especially need maps, as these are "a way of thinking. We are empty-handed without them in the lecture room, in the study, in the field. Show me a geographer who does not need them constantly and want them about him, and I shall have my doubts as to whether he has made the right choice of life" (Sauer, 1963:391).

The internet has brought about changes within the traditional universities by increasing the role of online learning (Glenn and D'Agostino, 2008:5-9), which makes documentation and learning to rely more and more on virtual environment. Consequently, the textbooks and other educational materials are easily accessible anytime, anywhere (Volery and Lord, 2000), which is very helpful for the students who already have a part-time job (Sursock and Smidt, 2010).

Virtual maps are also available in the university libraries (Dodsworth and Nicholson, 2012), but some of them contain errors, inasmuch as the most basic cartographic rules are trespassed. For this reason, many authors (Favretto, 2009; Borruso, 2010, *apud* Mauro, 2013:127) have begun to wonder if this is genuine cartography. Although the online maps are indispensable for the student-centered geographical learning, be it traditional, e-learning or mobile learning (Osaci-Costache et al., 2014:219), the errors they contain must not be overlooked, as the students might not be aware of their existence (Osaci-Costache et al., 2014:219). Hence our concern regarding the cartographic documentation of the students in virtual environment, especially because e-learning 2.0 tends to merge the formal academic activities with the informal ones, performed by the students themselves (De Pietro et al., 2013:128). The students in geography may spend even more than eight hours per day on the Internet, reading, downloading or sharing information with other people, including maps (Dulamă et al., 2015:57-58). During these online informal activities, they access information having a learning content of which they are not aware of (De Pietro et al., 2013). In this context, the guidance of the teacher is crucial, because his task is not only to provide information, but also to teach the students how to "search, filter, select, accept or reject" the information found on the Internet (Eco, 2007), and how to become "reflexive students" (Cinque, 2013).

Some online maps were considered potentially dangerous (Osaci-Costache, 2012:126), because they can disseminate in an uncontrolled manner cartographic or geographical contents of unverified accuracy (Borruso, 2010:249-250). Other maps were produced by lay people in the fields of geography and cartography (Buckley and Frye, 2011; Borruso, 2013:11; Bord, 2013:54), although they employed advanced software (Bord, 2013:54).

Based on the above considerations, this research focuses on two objectives: (1) knowing and analyzing the behavior of the students of the Faculty of Geography within the University of Bucharest with regard to the possibilities they have to make online cartographic documentations with the occasion of informal activities; and (2) finding solutions for optimizing the cartographic documentation in virtual environment, outside the institutional forms of activity.

2. Materials and Method

The survey investigated 58 students from the Faculty of Geography within the University of Bucharest, who accepted to answer anonymously and voluntarily to the questions included in a questionnaire. Of these, 82.8% were undergraduate students enrolled in the second or the third year of study (of which 34.5% were students in Cartography, 22.4% in Hydrology-Meteorology, 12.1% in Tourism Geography, 8.6% in Geography, and 5.2% in Environmental Geography), while 17.2% were graduate students enrolled in Master's programs ("Geomorphology and Cartography with Cadaster Elements", and "GIS"). We wished to have a larger sample, but our main purpose is not to generalize the results, but to identify the students' behavior concerning the documentation in virtual environment.

In order to fulfil our purpose, we designed an original questionnaire (as a data collection tool), which was accomplished with Google Forms from Google Drive, a method considered very useful (Vlada, 2014). The 20 items of the questionnaire were either multiple-choice or single choice questions. The request to fill in the questionnaire was sent to the students by e-mail at the end of the academic year 2014-2015. The subjects' answers are the material that underlies the present research.

3. Results and Discussions

By centralizing the answers, we were able to see that in order to accomplish a paper with geographical topic (essay/project/graduation paper/homework), 69% of the subjects use to start their documentation by surveying the scientific texts (printed or digital), while 31% begin by using the maps (printed or existing in the virtual environment). Nine students in Cartography (45%) started their documentation with the map, which proves that the study program has a certain influence on how the students relate to the map. However, for preparing an essay, a report, a project, etc., all the students add maps to the information derived from textbooks or other materials provided by the teacher (29.3% always, 50% frequently, and 20.7% seldom). In order to learn, only 96.6% supplement the received information with maps from the Internet (37.9% always, 39.7% frequently, and 19% seldom), while 3.4% never did this thing. The percentage of those who supplemented always or frequently the information provided during the teaching activities with maps coming from virtual sources ranges from 77.6% (for learning) to 79.3% (for the accomplishment of homeworks, projects, etc.).

When searching for cartographic materials on the Internet, students turn most frequently to Google Web (85.4%) and Google Images (67.2%), in order to visualize the thumbnail maps they have found. As for the rest, 25.9% seldom use the latter browser (in comparison with 12.1% who seldom use Goggle Web), while 6.9% never use it. 60.3% of the students used other browsers as well, either frequently (24.1%) or seldom (36.2%).

Most frequently, the maps were searched by using keywords in Romanian (84.5% of the subjects), in English (82.8%) or in other languages, according to the location of the territory (70.7%), so as to increase the students' chances of finding what they were looking for. Of these respondents, 27.6% used frequently keywords in a language they know (but having no relation with the territory concerned), 41.4% seldom used them, while 31% did not use such keywords. Only 10.3% used frequently French, 37.9% seldom used it, while 51.7% never employed French keywords.

The cartography sites recommended by the teachers were always used by 62.1% of the students, frequently used by 34.5%, seldom and never used by one student each (1.7%). All students searched by themselves for maps on the Internet, either always (46.6%), or frequently (44.8%) or seldom (9.6%). The sites recommended by collegues or friends are always used by few respondents (17.3%), frequently used by 50%, seldom used by 31%, and never used by 1.7%. 87.9% of the subjects preferred to download the maps from the free sites. Likewise, seven students (12.1%) accessed frequently and 22 (37.9%) seldom some paid sites offering good quality maps, while 50% never accessed such websites.

In order to view or to download large-scale maps the students preferred Maps/OpenStreetMaps/Bing Maps etc. (70.7% of the respondents used it frequently and 29.3% seldom), followed by Google Earth virtual globe (63.8% used it frequently, 34.5% seldom, and only 1.7% never). For uploading maps in GIS softwares, 58.6% used the WMS/WCS/WFS services frequently, 31% seldom, and 10.4 never used them.

The students were given homeworks that required maps. The origin of these maps was the following: the Internet (98.3%, i.e. 65.5% frequently and 32.8% seldom); Google Maps/OpenStreetMaps etc. (94.8%, i.e. 58.6% frequently and 36.2% seldom); Google Earth (94.8%, i.e. 48.3% frequently and 46.5% seldom); classical maps, printed on paper (93.1%, i.e. 75.9% frequently and 17.2% seldom); and the WMS/WCS/WFS (also 93.1%, i.e. 63.8% frequently and 29.3% seldom). Only 6.9% of the students never had homeworks requiring classical maps and the same percentage also applies for those who never had homeworks implying the WM(T)S services. One student (1.7%) was never given homeworks requiring virtual maps

By comparing the answers to the previous question, one can note that although 63.8% of the students were frequently given homeworks requiring the use of the WMS/WCS/WFS services, only 58.6% of them used the recommended service. The situation is opposite for Google Maps and Google Earth: for instance, only 48.3% of the students had to make homeworks requiring frequently Google Earth, but 63.6% actually used it for cartographic documentation in virtual environment.

The answers given to the question "*How frequently do you use maps from the Internet?*" confirmed that students spend a lot of time online, but most of this time is not devoted to learning. Thus, 39.7% of the interviewees accessed the online maps daily for geographical documentation, while 48.3% had other reasons in mind (looking up tourist attractions, addresses, etc.). For learning purposes, 46.6% used the online maps 8 to 20 times per week (in comparison with 34.5%

who used them for other reasons), 10.3% 20 to 30 times per week (in comparison with 21.1% for other reasons), and 3.4% more than 30 times per week (in comparison with 5.2 for other reasons).

On the other hand, 58.6% of the subjects declared they look for distinct maps, while 41.4% prefer to extract them by themselves from papers or other texts available online.

As far accuracy is concerned, 89.7% of the students thought that not all the maps in the virtual environment were correct, while the rest (10.3%) said they were not able to answer this question. However, by the instrumentality of educational activities it is possible to change the students' perception regarding the online maps (Osaci-Costache et al., 2014), so that to become aware that not all the maps are accurate. The answers revealed that only the students who were not involved in such teaching and learning activities were unable to assess the accuracy of the online maps. But the answers also suggest that before using a map the students always check the following elements: the presence of representative scale (75.9%), the map projection (62.1%), the date of the map or of the revision (51.7%), the source of the map (44.8%), and the datum (37.9%). Only 17.2% always check the author and other 17.2% never check the datum. The map scale, the revisions, the map projection and the source of the map are always or frequently checked by 81-91.4% of the students, while the author of the map by 51.7-58.6%. At the same time, important elements like map scale or revisions are never checked or seldom checked by 8.6-19% of the students (Figure 1).

The errors occurring on the maps downloaded from the Internet were observed by the students themselves as follows: 55.2% of them noticed them frequently, 41.4% only seldom, while 3.4% never noticed any errors. Previous studies have shown that the educational activities carried out with the students majoring in Cartography increased the share of students who noticed by themselves errors on the maps found in the virtual environment, which they used during a number of e-learning activities (Osaci-Costache et al., 2014). All the undergraduate students majoring in Cartography, as well as the Master's students, stated that they noticed errors, which is understandable, because these students had been previously involved in such activities.

On the online maps, the students noticed various errors and problems, as follows: obsolete maps (96.6% of the students, i.e. 62.1% frequently and 34.5% seldom); incorrect toponyms (94.9%, i.e. 46.6% frequently and 48.3% seldom); aesthetics errors (including erroneous colors) (89.7%, i.e. 70.7% frequently and 19% seldom); location errors (84.5%, i.e. 25.9% frequently and 58.6% seldom); and misuse of cartographic methods (82.7%, i.e. 51.7% frequently and 31% seldom). 17.2% of the students never noticed errors concerning the cartographic methods and 10.3% failed to notice aesthetics errors, which proves that many of them did not master the rules of cartographic representation.

Interesting are the answers given to the question "*What do you do if you think there is an error on a map from the Internet?*". Most students undertake correct actions (I document myself from several written sources; I compare the map with other maps on the Internet, etc.). For instance, 63.8% declare they always abandon the use of such a map, while 19% do this thing frequently. However, 12.1% use the map containing errors frequently and 5.2% do this always, hoping that the teacher will not notice. Although 56.9% ask the opinion of other collegues (always or frequently), only 15.5% turn always to a teacher's opinion. Many students (94.8%) inform (always, frequently or seldom) other people about the error. However, there are students who usually do not take any action if they find a map with potential errors: 5.2% use it anyway, 13.8% never try to document themselves from other written sources, 3.4% do not compare the problematic map with other maps, 13.8% never ask the opinion of a teacher, etc. (Figure 2).

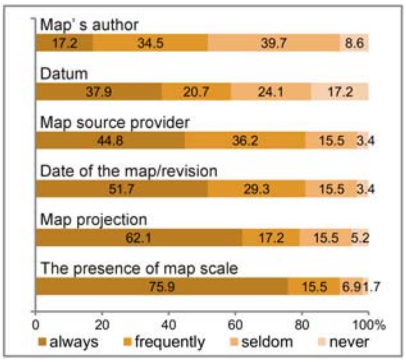

Figure 1. **Elements checked by the students when analyzing a map**

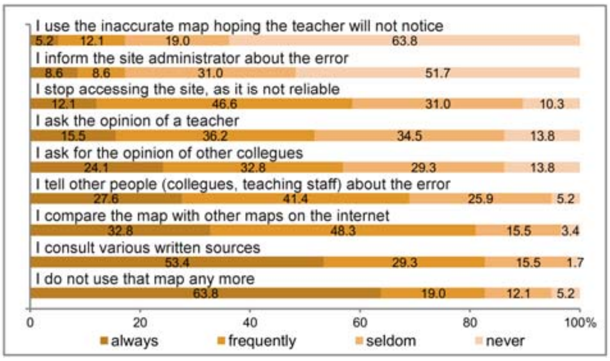

Figure 2. **Students' attitudes when confronted with an incorrect map**

It was our concern to find out why students access some of the most well known cartography sites: in order to learn, to accomplish their homeworks/projects or both. The first observation is that six of the ten analyzed websites were not used by too many students. Unfortunately, this group also included professional sites, as follows: the Atlas of the National Environment Agency (which 74.1% of the students did not access; http://atlas.anpm.ro/atlas); the maps of the European Environment Agency (69%; http://www.eea.europa.eu/data-and-maps/); The Territorial Atlas of Romania (65.5%; http://www.mdrl.ro/_documente/atlas/index.htm); the thematic maps of Philippe Waniez (68.6%; http://philcarto.free.fr/FondsDeCartes.html), etc. It was gratifying that many students (51.7%) were reluctant to use the maps posted on Profu' de geogra' (http://www.profudegeogra.eu/category/harti/), as they were full of errors. The websites most used *for learning purposes* were the following: geo-spatial.org (http://geo-spatial.org/harti/), Google Earth (25.9% each), Google Maps (24.1%), OpenStreetMaps (20.7%), Profu' de Geogra' (19%), and the Territorial Atlas of Romania (17.2%). In order to accomplish their *homeworks/essays/projects* the most accessed websites were OpenStreetMaps (34.5% of the students), as well as Google Maps and Google Earth (22.4% each). The most used sites *both for learning and for doing the homeworks* were geospatial.org (55.2%), Google Maps (53.4%) and Google Earth (51.7%).

From the geo-spatial.org website (created and supported by staff of the Faculty of Geography), which also offers WMS/WFS services, the students used the following items: the grid of the maps in Gauss-Krüger projection of scales ranging from 1:25,000 to 1:1,000,000 (26.7% of the students who know the site); the soviet topographic maps of scale 1:50,000 or 1:100,000, which unfortunately contain some errors; the Artilery Shooting Maps of scale 1:20,000 (19.3%); Romania's Geological Map of scale 1:200,000 (16.7%); and the Austrian maps developed around 1910, of scale 1:200,000 (15.3%).

Because historical cartography is a heritage included in the cultural-historical assets (Gatta, 2011:42), we wished to learn to what extent the students know and make use of such specialized sites. All the students knew the geo-spațial.org website and 57 (98.3%) already had used some of the historical maps available on this site. Another website used (by 36.2% of the subjects) or only known to the students is http://charta1864.ro/, which offers, free of charge, Charta României Meridionale (1864, 1:57,600). Old Maps Online (http://www.oldmapsonline.org/) was known to 43.1% of the students and used by 19%. As far as http://mapire.eu/en/maps/ is concerned (for the Historical Maps of the Habsburg Empire), this was used by 17.2% of the interviewees and known to 31%. Only 6.9% of the students had used the 3rd Military Mapping Survey of Austria-Hungary (1:200,000), while 74.1% had never heard of this site where everybody may have access to these maps (http://lazarus.elte.hu/hun/digkonyv/topo/3felmeres.htm).

A search with Google, using the words "harta Subcarpatii Getici" (i.e. maps Getae Sub-Carpathians) brought us in front of several incorrect maps hosted by the Profu' de geogra' site. As the maps can also be found by the students, we wished to learn their opinion regarding that site. More than half subjects (51.7%) did not know or did not use the maps posted there, 29.3% answered they were acceptable, 12.1% said they were good, and 6.9% stated they were full of errors.

At the moment when this research was carried out, the students felt the need of a national cartographic portal providing various quality cartographic materials. In this respect, they wished much and very much up-to-date topographic maps (91.4%); thematic maps (86.2%); thematic vectorial layers (79.3%); large-scale topographic maps and historical topographic maps (77.6%), thematic raster layers and old or new ortophotoplans (70.7%); and DEMs of various resolutions (67.2%).

4. Conclusions

The students already have the habit of supplementing their documentation with virtual maps (all do this thing daily in order to accomplish various homeworks, while 96.6% do it just for learning), but only 31% begin their documentation by studying the maps. Although most of them pay attention to the accuracy of the cartographic materials, 41.4% seldom notice the mistakes, while 3.4% never notice them, which is why the teacher should insist on the learning of cartographic rules. However, 17.2% of the interviewees have continued to use incorrect maps; for this reason, the teaching staff will have to take into account such kind of approaches, to focus on how the students can check the maps' accuracy and to emphasize the necessity of making these checks. Because all the students searched maps on the Internet by themselves (87.9% on free sites, which are likely to disseminate incorrect maps), 46.6% of them accessing the online cartographic materials for learning purposes 8 to 20 times per week, the teaching staff should have a greater involvment in recommending the students professional cartography sites (including for historical maps). This is necessary especially because the websites recommended by the teachers have been used, always or frequently, by 96.6% of the students. At the same time, almost all the students (98.3%) have been given homeworks requiring the use of maps downloaded from the Internet. It would be useful if the teachers could accustom the students to use the WM(T)S/WCS/WFS services, as these offer reliable cartographic documents. Last but not least, the teachers should check the homeworks, in order to discourage the students from using incorrect maps.

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Google Earth Helping Virtual Learning in the Geographical University Education System in Romania

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Abstract

Geovisualisation, possible due to Web 2.0, brings its contribution to increasing the availability of geographical information, thus favouring virtual learning. In this context, we wanted to answer the question about university teaching staff's educational use of Google Earth in the Faculties of Geography from Romania. We had the following objectives: (1) to identify aims, competences, abilities, disciplines, topic types, etc. for which the university teaching staff used this geobrowser; (2) to understand the limitations and reasons why they did not use it; (3) to disseminate good practice in using it. We were able to accomplish these objectives through getting answers from the teaching staff in Geography departments or faculties of seven Romanian state-owned universities. We administered an online questionnaire including 11 items and 58 colleagues answered. Answers showed the spread use of Google Earth (94.8%), especially the optional use of this geobrowser, both during formal and informal didactic activities. Results confirmed the modernising trend for teaching Geography in the university education system, thus enabling the efficient learning of geographical knowledge and forming or developing certain abilities and competences.

Keywords: virtual learning, university teaching staff, online survey, competences

1. Introduction

Still from 2008, after only three years since launching Google Earth (https://www.google.com/earth/), virtual globes ("virtual maps of the world"; Favretto, 2009) were very popular as it was proved by the results of a questionnaire administered to 120 inhabitants of Münster (Germany), where 59.2% of the respondents used them, with diverse aims, more than five times a month, while 92.5% of them used digital maps with the same frequency (Schöning et al., 2008).

At present, there is a series of virtual globes (Word Wind – NASA, 2003, Virtual Earth – Microsoft, 2005, Explorer for ArcGIS– ESRI, 2006), but Google Earth is the most popular. Although its strength is visualisations (from satellite imagery to orthophotoplans cf. Favretto, 2009:20, the possibility to compare several images of the same place at different points in time, vectorial thematic strata and three-dimensional models of buildings, all of them superimposed on the DEM), users can also carry out some interactive activities (marking a place with a symbol, measuring distance, inserting texts, photos, or vectorial and raster thematic strata, etc.), but which are still "close to nothing for spatial analysis" in comparison to the analysis in GIS (Favretto, 2009:21). In fact, researchers noticed that the use of virtual globes was "restricted to a small set of tasks so simple that they did not involve any spatial thinking" that required users to ask "what is where" and "why" because the most common virtual globe tasks only include the "what" (Schöning et al., 2008:1). In this context, Butler (2006, *apud* Favretto, 2009:29) underlined that common users perceived virtual globes as a simple and marvellous way to visualise space, while specialist users considered them as a shortcut to the complex and complete GIS programmes. Nevertheless, geographers used a so called "spatial reasoning" while noticing space features and explaining them (Patterson, 2007; Bodzin and Cirucci, 2009; Favretto, 2009; Guertin et al., 2012).

Using Google Earth in science (Geography, Cartography, GIS, etc.) is not widespread because of the limitations characteristic of virtual globes: sacrificing cartographical rigour and territorial analysis to their main function which is visualisation (Favretto, 2009) and presenting areas with different levels of information quantity (Giannola, 2013). Moreover, they enable the danger of dilatants' realising maps (Buckley and Frye, 2011; Borruso, 2013; Osaci-Costache et al., 2014), because common users ignore the reference system, the datum, the cartographical projection, the numerical scale, the legend for vectorial thematic Cartography or for satellite imagery (Mauro, 2013: 127-128). The Didactics of Geography points out the same limitations.

Despite these limitations, specialists have the possibility to import their own data, while some advantages turned virtual maps and/or globes into a practical tool and into a reference point for rescuers and people in danger while managing crises situations such as the terrorist attack on Word Trade Centre in 2001 or the floods caused by hurricane Katrina in 2005, when local GIS resources were damaged or unavailable (Schutzberg and Francica, 2005; Curtis et al., 2006; Favretto, 2009).

Research showed that for didactics virtual globes were complementary to pupils' and students' traditional training with atlases and they could be also a new resource for Geography and Cartography in general. Researchers proved a successful use of Google Earth especially in the pre-university system for studying plate tectonics (Blank et al., 2012; Mulvey and Bell, 2012), oil spills (Guertin and Neville, 2011), diverse geographical applications (Galbin, 2015), wave dynamics (in Physics – Logiurato, 2012), and also in universities, for creating e-portfolios in Google Earth (Guertin et al., 2012), in interdisciplinary studies (Williams and Davinroy, 2015), for understanding geological time (Parker, 2011), and in university libraries (Dodsworth and Nicholson, 2012).

Using virtual globes in complex situations like in land use management – because of the "information presented in ways that are clear, digestible, and yet nontrivial" (Bishop et al., 2013:214) – or in landscape visualisation at different scales (e.g. local, regional) is essential (Bishop et al., 2013). In addition, using virtual globes during disaster management is another reason to get Geography students learn about using them during formal (in institutions) and informal (due to their virtual availability) educational activities. Creating a simulation of the environmental situation in a realistic visual way to get emotional answers (MacEachran and Kraak, 1997) may also enable learning because with "its modern, digital version, scientific visualisation links science, technology, computer science, and applied visual arts in the designing of systems that can translate huge amounts of quantitative data into digital graphic images (Yair et al., 2003:44).

Focusing teaching-learning on using a visual communication means, underlining the observation process (Yair et al., 2003) may benefit from the aid of Google Earth, which is a modern educational means, based on visual information which is essential for Geography and Cartography. In contrast to a topographical map or to a classical thematic one, geobrowsers and GIS programmes allow for interactive graphical changes of the way of representing thematic geographical information (e.g. choropleth maps, chart maps), which enable both learning and the quantity and quality of information taken from maps, as well as the cognitive processes, etc.

Taking these into account, we had the following objectives: (1) to identify aims, competences, abilities, disciplines, topic types, etc. for which the university teaching staff used this geobrowser during teaching and learning; (2) to understand the limitations and reasons why they did not use it; (3) to disseminate good practice in using it for learning.

2. Materials and Methods

Participants. The respondents in our research were the professors from faculties and departments of Geography from seven state-owned universities in Romania. 58 were those who accepted to complete the questionnaire, but the sample size does not replicate the total population of the didactic personnel from the respective faculties and departments. Out of those 58, 32.8% were from the University of Bucharest (the Faculty of Geography), 17.2% from "Babeş-Bolyai" University in Cluj-Napoca (the Faculty of Geography), 12.1% from "Ştefan cel Mare" University in Suceava (the Faculty of History and Geography) and the same from West University in Timişoara (the Faculty of Chemistry, Biology, and Geography – the Geography Department), 8.6% from the University of Craiova (the Faculty of Mathematics and Nature Sciences – the Geography Department), the same from "Al. I. Cuza" University in Iaşi (the Faculty of Geography and Geology), and the same from the University of Oradea (the Faculty de Geography, Tourism, and Sports – Department of Geography, Tourism, and Territorial Arrangement).

Considering their didactic experience, most respondents (32.8%) had taught between 15 and 20 years, 22.4% between 10 and 15 years, 19% between 5 and 10 years, and 12.1% had taught for less than 5 years. Those who had taught for more than 20 years represented 13.8% (6.9% between 20 and 25 years, 5.2% over 30 years, and 1.7% between 25 and 30 years).

Method. We collected data using an 11 items questionnaire focusing on diverse issues about using Google Earth in the Geography university education system. We included multiple choice items where respondents could choose only one answer and open answer items. We realised the questionnaire on Google Forms from Google Drive, using the e-mail to send the invitation to professors asking them to complete the questionnaire. Their participation at the end of the 2014-2015 academic year was voluntary and anonymous.

The material of this research included professors' answers to the items in the questionnaire.

3. Results and Discussions

Results showed that 55 professors (94.8%) used Google Earth in education (for formal teaching-learning activities), 48 (82.8%) used it in research activities, two professors (one of them who had taught between 5 and 10 years, the other between 10 and 15 years; 3.4%) used it exclusively in research, and only one, who had taught for over 30 years (1.7%) never used it. More than three quarters (46 professors; 79.3%) used it both in education and research, while 9 (15.5%) used it only in education. We underline that 57 (98.3%) of the 58 professors recommended it for learning activities at home.

Considering the study level, the percentage of professors who used/recommended it increased from the 1st to the 3rd year, where it reached a maximum (81.1% of the professors: 55.2% recommended/used it frequently and 25.9% rarely). Then, values decreased towards the 2nd year of the Master's level, which also had the highest percentage of professors (34.5%) who never recommended it for use. Even if we expected that they recommended it more to Master's students, this result could be explained through the fact that not all respondents had courses/seminars at the respective level so they could not have recommended it to those students (Figure 1). Another explanation for its reduced use at the Master's level could be that students' already knew GIS that they used to access more specific information for their study field, while Google Earth offered more general information.

Respondents mainly recommended this geobrowser for *disciplines within Physical Geography* (38% of the total use cases, including: The Physical Geography of Romania, Environmental Geography, The Geography of Soils, Geomorphology, Hydrology, Biogeography, The Geography of the Black Sea, Oceanography, General Physical Geography, etc.). 25% of the use cases included *disciplines within Human Geography* (Geography of Human Settlements, Geography of Tourism, Urban and Rural Geography, Organisation of Geographical Space, Tourist Regions, Seaside and Mountain Tourism, Land Use, etc.). Other 22% belonged to *disciplines within Technical Geography* (Geographical Aerophoto Interpretation, Photogrammetry, GIS, Teledetection, Cartography, Digital Cartography, Geoinformatics, etc.). The disciplines where professors used this geobrowser the least (15%) were *those within Regional Geography* (The Geography of the Carpathians and of the Sub-Carpathians, The Geography of Continents, Territorial Systems, Territorial Planning, Protected Areas Management, etc.). It may be that Google Earth is more useful for some disciplines (e.g. where they need maps and satellite imagery more) and professors' digital competences may not be the cause for different use within the three branches of Geography.

Out of the 55 professors who chose it during teaching, 51 (92.7%) decided that it was optional for students, and 4 (7.3%) required that it was mandatory for Bachelor's and Master's theses at Oceanography, The Geography of Seas and Oceans, The Geography of the Black Sea, Coastal Dynamics and Remodelling, Natural and Human Hazards and Risks, Assessment and Management of Natural and Technogene Risks, Dendrochronology, Environmental Geography, Teledetection, Photogrammetry, GIS, Using GIS in Analysing Natural Processes and Phenomena, Cadastral Photogrammetry, and at Tourist Regions and Regionalisation.

The professors who used Google Earth or recommended it to their students aimed at the following competences: identifying relevant geographical features (70.9% of the professors), reading maps (69.1%), analysing geographical information/spatial relationships (67.3%), identifying landscape changes (58.2%), processing geographical information (43.6%), critical thinking (36.4%), synthesising geographical information (25.5%), and making decisions after assessing information (23.6%).

Professors targeted the following abilities: expressing localisation (69.1% of them), describing conditions in certain places (67.3%), comparing places (63.6%), identifying spatial patters (63.6%), delimiting regions (58.2%), identifying connections to other places (52.7%), comparing spatial patterns (47.3%), analysing diachronic changes within spatial patters (38.2%), determining the influence areas of places (30.9%), creating spatial models by underlining relationships between places (27.3%), identifying places similar to a certain place (20.0%), and identifying exceptions to the rule (20.0%). One professor (1.8%) mentioned integration of GIS data.

Only 17 professors (of the 55 who used it with a didactic purpose) considered that, occasionally, there were reasons not to use it. 10 professors (58.8%) mentioned the poor signal strength of the Internet connection as the main problem. Other problems were: lack of PCs in the respective faculty (47.1%), impossibility to integrate it into their courses because it did not fit to the topic (17.6%), and students being reluctant to use it (5.9%). One professor (5.9%) mentioned also other reasons: no video projector and no Internet connection which could be real permanent problems in some rooms, but occasionally in any room. No video projector meant also accidental not functioning and in that case the use of Google Earth during courses was compromised. Even though our questionnaire included two more reasons for not using this geobrowser (e.g. "it does not seem a serious tool" and "I do not know it"), no professor considered them.

The professors who used Google Earth mentioned its strengths during didactic activities: illustrating issues during courses/seminars (70.9%), forming/developing abilities (69.1%), using updated satellite imagery (63.6%), landscape visualising (61.8%), enabling understanding of concepts (space, time, development, planning, culture, etc.; 60%), forming/developing competences (50.9%), increasing the learning attractiveness (47.3%), and being a first step before learning GIS (40%). One professor (1.8%) mentioned also that "it was free and students could access it also at home".

Some studies (Schroth et al., 2015) demonstrated that the three-dimensional landscape visualisation, associated with the fourth dimension – time (like in Google Earth) – was the presentation means with the strongest impact upon being aware of certain presented issues and upon assessing them, and our research proved that more than half of the professors used it because of this reason.

Related to the aim and frequency of recommending the use of Google Earth at home, the most frequent recommendation was for projects/scientific papers/homework/Bachelor's theses (67.2% of the professors; Figure 2), followed by using it as a cartographical aid during courses/seminars (to visualise a glacial valley, a terrace, a certain landscape type, etc.; 62.1%). 94.8% recommended it frequently/rarely for the satellite imagery (which was updated and used in scientific research for diachronic cartographical analysis; Gregori, 2008). Using it as an auxiliary of the geographical atlas for learning was the reason mentioned by 93.1% of the professors (out of which 55.2% recommended it frequently), while 77.6% represented the lowest number of professors who recommended it (frequently/rarely) for exercises enabling using/understanding theory. 57 of the 58 professors recommended it for informal activities.

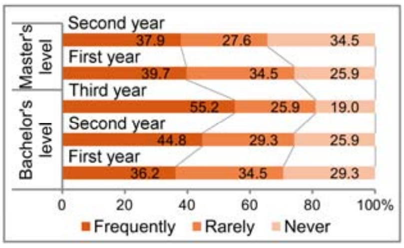

Figure 1. **Use of Google Earth during formal educational activities**

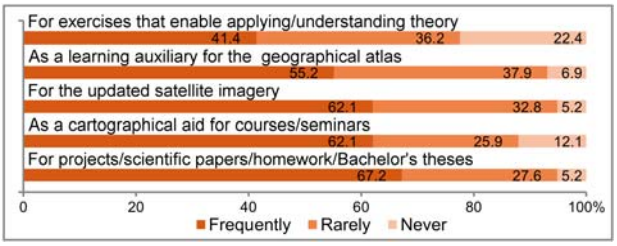

Figure 2. **Aim and frequency of recommending Google Earth for informal educational activities**

4. Conclusions

1) *Aims, competences, abilities, and disciplines for which university teaching staff used this geobrowser during teaching and learning.* We noticed that most of the professors (94.8%) used Google Earth for education, especially for the 2nd and 3rd years with undergraduates and for the 1st year of the Master's level, for disciplines within Physical Geography and less for those of Regional Geography. In most of the cases (92.7%) its use was optional and targeted forming competences (e.g. identifying relevant geographical features and interpreting geographical information – 70.9% of the professors, reading maps – 69.1%) and abilities (e.g. expressing localisation – 69.1% of the professors, describing features of places – 67.3%), both in formal and informal didactic activities.

(2) *Limitations of and reasons for not using Google Earth during learning Geography in the Romanian university system.* Even if 55 professors used it, 17 had some occasional difficulties (e.g. poor signal strength of the Internet connection, no video projector) and those could prevent them from using this geobrowser while teaching. 57 of the 58 professors recommended it for informal didactic activities (e.g. 94.8% recommended it for realising projects/scientific papers/Bachelor's theses), even if only 55 used it during formal didactic activities.

(3) *Good practice in using Google Earth for learning.* This geobrowser was useful for realising projects/scientific papers/homework/Bachelor's theses (94.8% of them agreed), as an auxiliary to

the geographical atlas (93.1%), as a cartographical aid for courses and seminars (87.9%), for illustrating certain issues during courses and seminars (70.9%), as a source of satellite imagery (63.6%), for landscape visualisation (61.8%), for increasing the learning attractiveness (47.3%), and a step before learning GIS (40%), etc.

Because it is free and can be accessed anytime and from anywhere, the use of Google Earth acknowledges the modernisation trend in the Geography university education system in Romania, enabling the efficient learning of geographical knowledge and the forming or developing of certain abilities and competences.

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E-learning Geography. How Powerful Is Facebook for Geography University Students?

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Abstract

Most of our Geography university students spend daily plenty of time to socialise on Facebook. The objective of our research is investigating the way in which Geography university students use Facebook to learn Geography. In 2015, we administered a questionnaire to 29 students in the second and third year of their university studies, at diverse specialisations in the Faculty of Geography, "Babeş-Bolyai" University, Cluj-Napoca, Romania. This questionnaire included 14 items focusing on: the lists of geographer friends, professors' and students' shares, professors' shares and recommendations, activity typology, the typology of the Geography materials that respondents' read or looked at, the origin of the sources that respondents read, frequency and aim of sharing; sharing criteria, respondents' reaction at incorrect or falsified materials, information assessment criteria, the language in which respondents' read and shared materials. Our findings show that Geography university students form on Facebook an active learning community where they solve Geography problems, discuss Geography topics, and organise geographical events. Our recommendation is that their professors get more involved into building academic communities for learning, associated to their courses. At the end our study, we make a series of proposals for stimulating learning through Facebook.

Keywords: Virtual learning environment, Higher education, Online survey, Networking, Learning community

1. Introduction

Facebook is a socialising network type website on the Internet, created by Mark Zuckerberg in 2004. At first, it was created at Harvard as a close circuit social network for the students of this university, and afterwards it opened to other American universities. In 2015, this largest social network in the world has over one billion members. Users can register using a password from anywhere there is access to Internet. Taking into account the number of visits, Facebook is the second largest worldwide social site after google.com. It partakes of the recently named phenomena Web 2.0 (Cerdà and Capdeferro, 2011).

Due to its facilities, Facebook is not merely a means of having fun, of exchanging ideas and of communicating, but also an online learning environment. Thus, "Facebook has potential for teaching and learning because of its unique built-in functions which offer pedagogical, social and technological affordances" (Munoz and Towner, 2009; Cam and Isbulan, 2012; Hew and Cheung, 2012; Selami Aydin, 2012; Wang et al, 2012, apud Alias et al, 2013, p. 60).

The advantages and disadvantages analysis of Facebook for teaching/learning may be realised according to the following criteria (Selami Aydin, 2012 apud Alias et al, 2013, p. 60): “Facebook users; reasons people use Facebook; useful and harmful effects of Facebook; Facebook as an educational environment; Facebook effects on culture and language; and the relationship between Facebook and subject variables (interaction, collaboration, engagement, motivation for learning, collaboration using Facebook, etc.)”. Literature shows the advantages and the limitations of using Facebook to learn (Cerdà and Planas 2011; Alias et al, 2013; Pappas, 2015) (Table 1).

Table 1. **Advantages and Disadvantages of Using Facebook when Learning**

Advantages	Disadvantages
- it is open for anyone who has Internet access; - it favours social learning; - it enables co-operation between those who learn; - it supports in-depth learning (it ensures learning motivation, it stimulates discussions and debates, etc.); - it stimulates critical thinking and enables the cognitive processing of the contents (similarly to any web 2.0 technology); - it stimulates creativity because it allows the integration of diverse resources: images, films, audio files, etc.; - it requires small financial resources (required by collecting and processing learning materials);	- sometimes it diverts the attention of the persons who access Facebook; - it is not entirely safe; - it allows for a limited control of the learning contents; - it does not ensure feedback for learning results.

Opinions about using Facebook for learning differ. For instance, Cerdà and Planas (2011, p. 199) make a plea for the efficiency of Facebook in learning because

> *it "has enormous potential in the field of education despite the fact that it was not designed as an environment for constructing and managing learning experiences. It operates as an open platform, unlike other systems organised around courses or formally structured content. In fact, while Facebook is not a learning environment, either in its underlying concept or the design of its tools, it can serve as a very valuable support for the new social orientations now prevailing in approaches to educational processes".*

Alias et al (2013, p. 60) showed that “the potential of Facebook for teaching and learning has been proved through using its group as a Learning Management System”. Still, Hew and Cheung (2012) found out that students used it especially for socialising, not to learn (apud Alias et al, 2013).

Bicen and Cavus (2011) investigated the use of the tools offered by Facebook and which students preferred. Results showed that students spent plenty of time on Facebook and that they mostly used the messages, the chat, friends, the links, the news, and the photo options.

On the basis of analysing a leadership course using socialising networks, Ortega (2013, p. 1672) argued that using Facebook was useful for stimulating and encouraging self-reflection and discussions, for students’ stronger involvement into discussions on certain topics, and thus for an improvement of learning. In order to create an environment for co-operation, Ortega (2013, p. 1672) considered essential that one respected students’ privacy and appreciated their contribution.

Livingstone and Brake (2010) considered that one should have “investigated children’s and youngsters’ online social practices because their enthusiasm for using socialising networks was undeniable” (apud Iordache, 2014, p. 195). Iordache (2014, p. 195) argued that: socialising networks were used in education because learning networks might appear between users; students appreciated the role of the socialising networks for learning and for creating new abilities, especially by means of the groups of interests and by means of the facilities offered by the SNS (Social Networking Site) for information transmission; the use of the groups of interests on socialising networks during the learning process required for an informal and optional use.

Taking these considerations into account, we wanted to research our students’ opinion about using Facebook for learning Geography.

2. Material and Method

2.1. Participants

This research focused on analysing the opinions of a sample including 29 students in their 2nd and 3rd year of study at diverse specialisations (*Geography, Geography of Tourism, Hydrology-Meteorology,* and *Cartography*) at the Faculty of Geography, "Babeș-Bolyai" University in Cluj-Napoca, Romania. The sample size does not correspond to the total student population at this faculty. Generalisation of data may be influenced by the fact that this research focused only on one faculty.

2.2. Procedure, Data Collecting and Research Material

In order to collect the data, we used an online questionnaire survey realised with the Google Forms application from Google Drive. We sent the invitation to complete the questionnaire anonymously through e-mail, in July 2015, to 101 students enrolled for a Psychology and Pedagogy module. Out of these, 29 students volunteered to complete this online questionnaire. It included 14 items about students' and professors' (from the Faculty of Geography) involvement into e-learning activities in the field of Geography. These items focused on: the lists of friends (1), the shares according to their source (professors, students) (2), professors' shares and recommendations (3), typology of activities (4), typology of the Geography materials that respondents read or looked at (7), frequency and aim of sharing (8, 9); sharing criteria (10), respondents' reaction to incorrect or falsified information (11), criteria for assessing materials (12), the language of the materials they read and shared (13-14).

3. Results and Discussion

Analysing *the lists of friends* on Facebook, we underlined that 75% of respondents answered that they had in their lists more than 20 colleagues from their specialisation in the Faculty of Geography, 39.3% had more than 20 colleagues from diverse specialisations and from diverse years of study. Taking into account the number of students in a year, these results showed a high socialising level within the faculty which was favourable for transmitting information in this virtual learning environment. Respondents said that they had a small number of professors from their faculty in their lists: 1-3 professors (60.7%), 4-6 professors (25%), and over 6 professors (14.3%). The cause could be either professors' little involvement on Facebook, or students' inhibition from socialising with their professors especially because they could analyse their virtual profile. Students are aware that lack of anonymity on Facebook requires responsibility during discussions, and its public feature means that students ponder before writing something. Professors' little involvement in this network is a disadvantage for building a learning academic community.

Analysing respondents' answers about *following the shared materials*, 78.6% said they followed *frequently* what was shared by colleagues from their year of study and specialisation and that meant they functioned as an active community. Respondents argued they followed *rarely* what was shared by professors' from their faculty (53.6%) and by colleagues from other specialisations (60.7%). We explain this option with students' following also other activities of their colleagues, not only those related to study. Facebook offers plenty of ways to follow others' posts: through the *Home* option, it lists the recent posts of those on the list of friends; using the *Follow* button, one may choose from reading new posts, all posts, or one may stop following. The following is not registered and may be passive, with no Likes, comments, or questions.

We also analysed how respondents perceived *the involvement of professors from their faculty in this network,* in relationship to their students. Respondents (59.3%) noticed that their professors' *rarely* shared materials with the recommendation to study them. We concluded professors use

Facebook very little for their courses as a means of sending and receiving information, as a learning environment for their students.

Respondents said that professors *rarely* (35.7% of the students) or *never* (46.4%) asked them whether they studied certain Geography materials shared on Facebook. This shows professors' weak involvement in this socialising network compared to students', who are active participants. For instance, all the 30 Geography students in their 3rd year of study, from diverse specialisations, asked by Dulamă et al (2015, p. 55) had a Facebook account, while 27 of them joined diverse Geography groups, such as: Faculty of Geography, "Babeş-Bolyai" University Cluj-Napoca (11 respondents), Geography didactic module (9), geographers and teachers (6), EGEA Cluj-Napoca (3), GIS Romania (3).

Referring to *the activity typology,* we concluded that Facebook could be an efficient and thus strong tool for co-operative learning because respondents used it *frequently* to solve Geography problems through messages (78.6%) and for discussing Geography topics with colleagues from their year of study and specialisation (65.4%).

Respondents used Facebook *frequently* to organise their participation at geographical events (e.g. trips, walks, and visits) (75%), and not only for expressing their civic spirit, but also interest in topics for Geography research (e.g. environmental studies and Political Geography) in cases like manifesting against gold mining in Roşia Montană and against exploiting shale gas through fracking, and like at the presidential elections in 2014 – after the elections, some of the Romanian media called Facebook the "Facebook Party" because of its political role (Dulamă et al, 2015).

About *the Geography materials typology,* we noticed respondents read *frequently* on Facebook: scientific papers, papers from Geography sites, papers from Geography blogs, quotations, and sayings (Figure 1). They read *rarely* presentations of Geography books because these were also shared rarely, the number of such new books being small in Romania, with small circulation and on a small area. Students said they read newspapers, PowerPoint presentations, Geography studies for certain countries, geographical curiosities, and touristic offers. One respondent underlined that he or she followed on Facebook the activity of certain foreign scientific Geographical Societies.

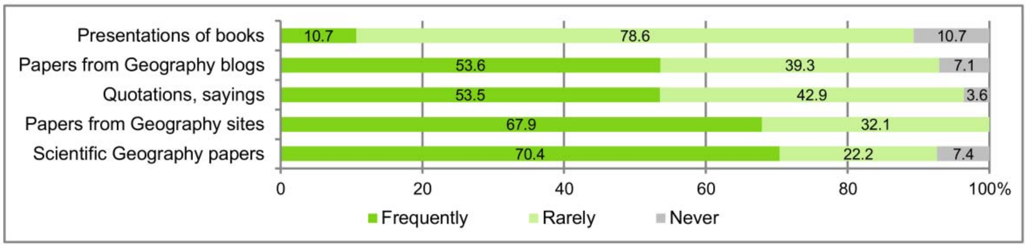

Figure 1. **Geography Materials Respondents Read**

Referring to *the typology of the Geography materials that respondents looked at*, we noticed that they looked *frequently* at photos with geographical content and at maps, while they looked *rarely* at the following materials with geographical content: schematic drawings, animations, caricatures, video games, and documentaries (Figure 2). These options showed us rather the fact that those materials were not so often shared on Facebook in comparison to photos and maps, than the fact that students would not look at them were they more frequent and their quantity larger. Respondents underlined a feature of Facebook as an environment for sharing short videos about diverse live phenomena (e.g. volcanic eruptions, earthquakes, landslides, development of plants, river pollution, etc.) and that they liked to watch them. These short videos which are sometimes viral on Facebook could be used in teaching as they show the dynamic, the uniqueness, and momentousness of certain geographical phenomena. Respondents also underlined their interest in watching documentaries about the promotion of touristic sites from Romania, and that was another learning opportunity.

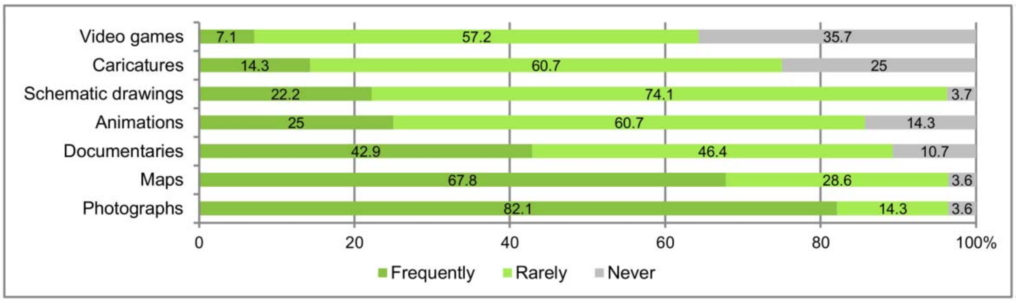

Figure 2. **Geography Materials Respondents Looked at**

Analysing *the sources of the materials students read,* we noticed that they *frequently* read on Facebook the ones shared by colleagues from their specialisation, by diverse groups of geographers, and by the Facebook page of the Faculty of Geography (Figure 3). These data showed us a positive situation: students trusted those sources, they considered them safe and they might have also felt that they were members of those communities of geographers in Romania. We noticed that respondents read *rarely* on Facebook Geography materials recommended by their professors (Figure 3), maybe because the number of professors joining this socialising network was small and they were also less active in comparison to their students. Knowing their students' preference for Facebook, professors should get more involved professionally.

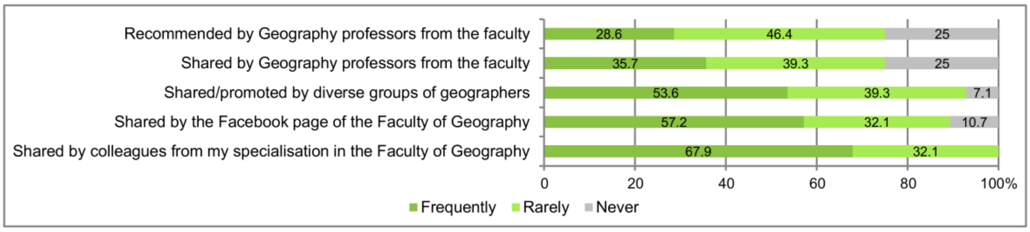

Figure 3. **Sources of the Geography Materials Respondents Read**

Analysing *the frequency of sharing Geography materials*, we noticed that our respondents shared *rarely*: maps (60.7%), quotations and sayings (57.1%), schematic drawings (55.6%), papers from Geography sites (53.6%), documentaries (50%), scientific papers from academic journals (50%), papers from Geography blogs (50%), and photos (46.4%). When sharing such a material, many (not necessarily all) friends from the list may see it. Respondents said that they *never* shared on their Facebook profile the following Geography materials: video games (64.3%), presentations of books (60.7%), caricatures (60.7%), and animations (59.3%). Their absence or the fact that they were little present on Facebook might have been the cause for students' not sharing such materials. Nevertheless, we have noticed the intense promotion on this network of caricatures about deforestation which is a serious problem Romania has to cope with nowadays. We underline that in the questionnaire we did not mention whether those shared materials should have been original or realised by other persons. One student said that he or she shared relevant or interesting information from Geographical Societies and that he or she recommended them to colleagues, but not to use them for study or research.

Considering *the aim of sharing,* respondents argued that they shared *frequently* on their Facebook profile Geography materials in order to promote special places from Romania and from other countries (48.1%) and to share those with the others because they considered them interesting (46.4%). 14.5% of them said they shared *frequently* Geography materials in order to be able to look at them again if they needed to, while 50% did that *rarely.* 22.2% shared *frequently* Geography materials so that other colleagues from their specialisation studied them, while 44.4% did that *rarely*. A future question to research is whether they download the materials they are interested in because Facebook has some disadvantages: difficulty in finding again a certain material, even on one's own profile as there are not search facilities; one cannot classify shared materials according to their topic as the only ordering facilities are the chronological one and according to a certain author or Facebook profile. Respondents (60.7%) said they *never* shared Geography materials in order to find out if they were true or false, or because they were intrigued, while 7.1% said they did that *frequently* and 32.1% *rarely.* Facebook has dialogue boxes where anyone may ask the ones who read or visualise a material, but it is difficult to follow answers on somebody else's profile and if people do not answer at once. Moreover, when one shares materials on his or her Facebook profile or on somebody else's, comments are not transferred. Another weakness of network communication in comparison to communication during courses and seminars is that questions are not always answered although some know the answer, because they avoid becoming public, in writing.

It is good that respondents (74.1%) *always* shared on Facebook Geography materials only after they read them. Respondents did not Like shared materials taking into account the person who shared those materials. Thus, they *rarely* Liked (33.3%) or *never* Liked (33.3%) Geography information shared by professors or students they knew from the Faculty of Geography. Still, 33.3% *always* or *frequently* Liked the materials shared by professors, and 35.7% Liked those of the students they knew.

About the shared Geography materials that had incorrect or false information, respondents *rarely* noticed any comments from their professors (50%), their colleagues (59.3%), or from other persons (53.6%). Because they run the risk of using in other contexts incorrect information from Facebook, students should learn to select it using their critical thinking or by comparing it to information from other sources.

Respondents *frequently* considered that information on Facebook was correct if: professors from the Faculty of Geography shared it (63%); it was on a renown Geography site (61.5%); the authors were Geography professors or teachers (59.3%); it was from renown scientific journals (57.7%); it had a reference list (51.9%). We underline that students recognise the authority of their faculty professors.

According to the language of the materials, 75% of the respondents read *frequently* on Facebook Geography materials in Romanian and 39.3% in English. 18.5% read frequently materials in other languages and 25.9% read those rarely (in French – 4 cases, in Spanish – 4, in German – 2, in Hungarian – 2, in Italian – 1). Respondents answered they *rarely* shared Geography materials in Romanian (51.9%) and in English (44.4%). We underline their preference for materials in Romanian. 61.5% never share materials in other languages.

4. Conclusions and Recommendations

At the end of our research, we reached a series of significant conclusions and we made several recommendations.

First, we found out that the respondents had in their lists of friends many of their colleagues from the same specialisation and from the same faculty and this was a proof of the high socialising level in the faculty which was favourable for e-learning. Nevertheless, the small number of professors interacting with their students on Facebook could be restrictive for e-learning.

Secondly, our respondents followed frequently what their colleagues from the same year and specialisation shared on Facebook and that meant they were aware of their belonging to the respective community and acted as its members. Still, following colleagues' shared materials could be passive sometimes, as they did not use Like, comment or ask any questions related to the respective materials.

Thirdly, while analysing the activity typology, we found out that our respondents used Facebook frequently in order to solve geographical problems, to discuss Geography topics, and to organise their participation to geographical events (trips, walks, and visits). This means that Facebook is an efficient and strong tool for co-operative learning and for organisational management.

Fourthly, while analysing the typology of the Geography materials they read, we realised that our respondents read frequently on Facebook: scientific papers, papers on Geography sites and blogs, quotations and sayings, and they frequently looked at photos and maps. At the same time, they rarely visualised other materials (schematic drawings, animations, caricatures, video games, and documentaries). In comparison to their interest for reading and watching, their interest for posting or sharing Geography materials was much lower, focusing on promoting special places from Romania and from foreign countries and of very interesting information.

Taking into account students' behaviour and interest in Facebook, we recommend that professors get more involved into creating an academic learning community, associated to their courses. In order to stimulate curiosity, proved in research, and to determine them to learn Geography, and to develop their critical thinking, on Facebook, the shared materials, especially the problematic ones, could have open questions as titles or they could come with multiple choice items or with true/false ones. Professors could attract students to learn Geography by using short texts and messages associated to images, photos, and maps, thus turning to good account their visual style of learning. In order for Facebook to function as an authentic learning community, it would be necessary that professors offer feedback to their students for their learning process and for their learning results (answers to questions, solutions to problems, and correcting their mistakes).

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Geography University Students' Skills to Research Online Sources. An Empirical Study

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Abstract

The aim of this research was to investigate and analyse Geography university students' skills and practices when searching for literature to write a Geography scientific paper. In 2015, we administered a questionnaire to a sample of 24 graduate students at the Faculty of Geography, "Babeș-Bolyai" University in Cluj-Napoca, Romania, who were studying for the pedagogy module. The questionnaire included 19 items about: the search engine they used, the places where they searched for literature, the procedures they used in searching for web sources, the selection and screening criteria for web sources, and the number of sources. At the end of our study, we reached a series of findings and conclusions. Firstly, the Internet and the Google.com search engine were the favourite of our Geography university students for literature search, in the detriment of the printed sources. As they were concerned about the trustfulness of the used sources, students searched for relevant, up to date and trustful information in peer-reviewed sources, in Geography web sources renown in the field, and on governmental sites. The discussion about the issue of Geography university students' skills for literature search should be continued with one about their reviewers' skills.

Keywords: Higher education, Web literature search, Screening criteria

1. Research Background

Literature search realised with diverse aims uses a varied series of media, from printed sources to the online ones. In fact, Fink (2014, p. 3) shows that "research literature review is a systematic, explicit, and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners." In addition, Bell (2005, p. 99, quoting Hart, 1998, p. 1) underlines the importance of researching for bibliography: "without it you will not acquire an understanding of your topic, of what has already been done on it, how it has been researched, and what the key issues are".

Blaxter et al. (2010, p. 100) shows that: quality literature search represents a source of ideas for realising research in a field/diverse fields; it enlarges the perspective upon the knowledge level in the identified field/fields; it ensures placing the research in the research context of the identified field; it offers support for arguing certain ideas, for the correct screening of results, for learning about the research itself, about the research methods and about their turning into practice, and about writing research papers.

The literature search rests on primary and secondary data. The first ones are the data that result as the product of research, while the latter are data that researchers do not create themselves but use in their research, such as the ones offered by governmental agencies, by diverse organizations and companies (Martin and Pavlovskaya, 2010, p. 173; Montello, 2012; Ciascai, 2014, p. 480).

The strategy of literature search has six stages (Notess, 2006, p. 1; Healey and Healey, 2010, pp. 17-34; Fink, 2014, pp. 4-5). (1) Asking questions that guide the review and selecting the most appropriate question. (2) Identifying the key terms to use during the search, terms that are linked to the respective research question, to the topic or to the field and to the peculiarities of web search. The search terms may be extensive (particular to a field) or limited or included in the question that guides the search. (3) Selecting a literature data base with diverse resources (papers, web sites, books, etc.) which are useful in elaborating the answer to the literature search question. The data base may offer access to references like library catalogues, abstract lists, citation indexes, free online journal articles, etc. Restricted access to some of these resources may be a problem, but the web hosts also partially or completely free resources (e.g. Google books.com). (4) Applying practical and methodological screening criteria with the aim to include or exclude a paper from the realised data base and to assess the scientific quality of a paper. Such selection, organisation, classification, and hierarchy criteria for literature sources are the following: the paper relevance for the research question, the publication type (peer-reviewed journal article, conference paper, a paper published in an unknown journal, etc.), originality (e.g. it includes primary and secondary data), quality of academic reasoning, the publishing language, paper type (e.g. research paper, a didactic one). Through screening, the data base decreases in quantity, but its quality increases as it includes only key references. (5) Reviewing each key reference, analysing and processing its data (realising a synthesis, abstracting, correlating information, interpreting data, etc.). (6) Descriptive synthesis of the resulted data after the analysis of the selected papers. The quality of this synthesis depends on the reviewers' experience and skills, and on the quantity and quality of the papers selected in the data base.

A quality literature search will lead to writing a quality paper, characterised by the originality of the theme and not only by the quality elaboration process. This also implies having certain literature search skills and knowledge about the validity of the literature sources (Healey and Healey, 2010, p. 16; Oliver, 2012, p. 9). At the same time, a good literature search on the web implies: knowledge about websites with good quality literature sources; technical searching skills using diverse sites and sources; knowing and observing screening and selection criteria for web sources; very good reading skills; high level reasoning (involving processes such as analysis, assessment, prediction, problems solving, critical thinking, and synthesis), a certain set of attitudes (curiosity, interest, and perseverance in solving a task).

Starting from these premises, in this research we wanted to identify the literature search skills and practices characteristic of Geography university students, necessary in searching the literature to write scientific Geography papers required during their studies, while knowing that "*a scientific paper* renders synthetically and logically the main ideas of a problem or of some ideas from one or a series of papers that are related through their topic, while underlining the authors' contribution, including critical elements and personal opinions on the researched topic" (Dulamă, 2008, p. 141).

2. Method

2.1. Participants

The research we realised during the 2014-2015 academic year focused on analysing 24 students' opinions (the sample included students who graduated Geography and were in the 1st and 2nd year of the didactic module at the Faculty of Geography, "Babeș-Bolyai" University in Cluj-Napoca, Romania). The sample size was not correlated to the total student population in this faculty. Limiting research to one faculty and the respondents' varied competence levels influenced results and data generalisation.

2.2. Procedure, Data Collecting and Research Material

We collected data through a questionnaire survey. We realised the questionnaire using the Google Forms application in Google Drive and then we sent it through e-mail to 60 students who enrolled for the second level of the psychological and pedagogical module. Out of these, 24 students filled in the questionnaire on a voluntary basis, on-line, while remaining anonymous. The questionnaire included 19 items about: the used *search engine*; *the place* where students started searching for literature, the web *places* where they searched for the most relevant, up to date and trustful literature sources; *the employed procedures* (for identifying and clarifying the used key terms before and during searching the literature; if the search engine found on the web not enough/too many references for a scientific paper; the primary screening of the information quality from a certain web source; whether the information from the web sources seemed incorrect; finding a useful web source for the research topic; preparing for quoting web sources; opening/visualising the respective sites after listing the web sources); the reasons for using certain procedures; selection *criteria* for web sources, screening *criteria* for assessing the trustfulness of the web sources; *the language* for searching web sources; *the number of sources* they searched for writing a scientific paper.

3. Presenting and Discussing Results

3.1. Analysis of the Used Search Engines

All respondents preferred the Google search engine (www.google.com) due to its services, and disregarded AlltheWeb (www.alltheweb.com), MSN (www.msn.com), Teoma (www.teoma.com), AltaVista (www.altavista.com), and WiseNut (www.wisenut.com).

3.2. Analysis of the Searched Web Places

According to *the place to start* searching for literature, in order to write a Geography scientific paper, the Internet was the first option for 62.5% of the students. Starting the search for printed literature in the faculty library was the first option for 25% of them, and the university library was the first option for 8.3%. Only one student started the search in his or her bookcase.

The site where students searched most frequently for the most relevant, up to date and trustful literature web sources for writing a scientific Geography paper was Google (100% of the respondents' answers). They also searched in books with reference lists (81.8%), on sites of institutions (for meteorological data, for topographical data, of local and regional administration, museums, etc.) (77.3%), in online library catalogues (75%), on data bases sites (63.7%), on governmental sites (54.5%), in specialty virtual libraries (54.6%), in "general use" virtual libraries (45.5%), and in newspapers (Figure 1). We underline that in some of these sources students find up-to-date primary and secondary data that need to undergo processing in order to be included in a scientific paper or students may use them to exemplify or as proof.

In order to write a good quality scientific paper, students should search through the entire literature approaching a certain subject. Even if all references were not available on the web, for a refinement of searching, we analysed the sites where students searched for relevant, up to date and trustful information/references. 87% of them declared that they always or frequently searched for such information in scientific/academic journals or in papers which had undergone a peer review process and they also searched on renown specialty sites in the field of Geography (Figure 2).

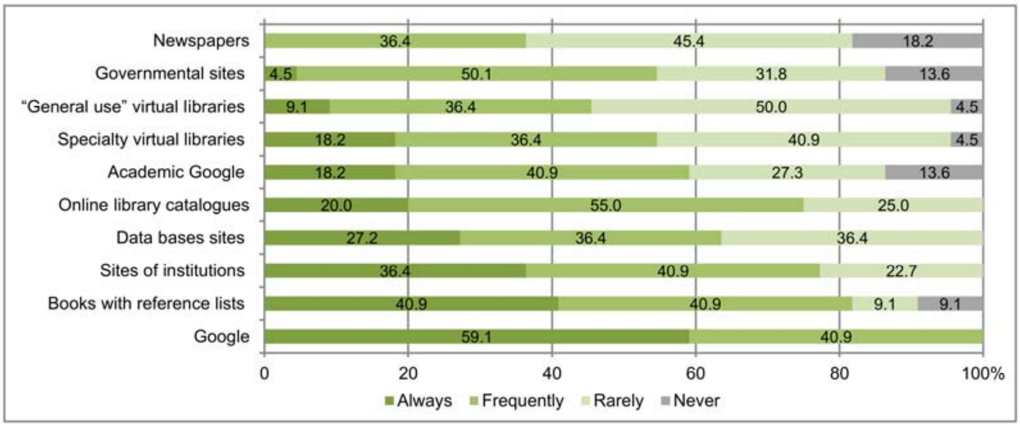

Figure 1. **The Sites Where Students Searched for the Most Relevant, Up to Date and Trustful Literature Web Sources for Writing Geography Scientific Papers**

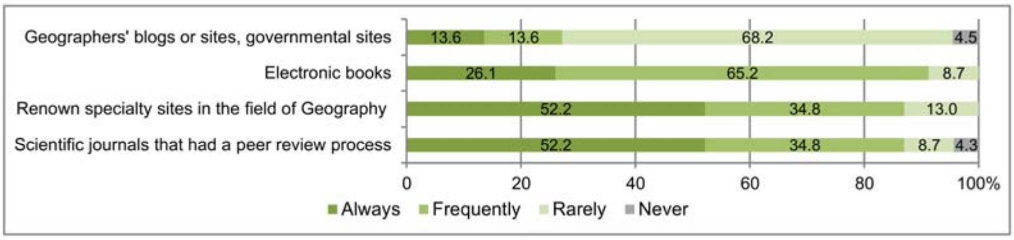

Figure 2. **The Web Sources Where Students Searched for Relevant, Up to Date and Trustful Information/References**

91.3% of them always or frequently searched for such information in electronic books. 27.2% of the students said that they always or frequently searched on university or pre-university geographers' personal blogs or sites, and on governmental sites.

3.3. Analysis of the Web Literature Searching Procedures

Procedures to identify and clarify the key terms used before and while searching for literature. (1) Before searching for literature on the web in order to write a scientific paper, 77.3% of the students *always* and 18.2% *frequently* identified the key words in the title. 59.1% of the students declared that they *always* did this *during the process of searching*, and 40.9% identified key words *frequently*. Students used procedures to identify key words both before and during searching for literature, according to the theme and concepts that might be correlated with it (synonyms, word families, nouns/verbs) and that could better the literature search. 33.3% *always* established a list of concepts that were related to the topic and 41.7% established that list *frequently*.

We consider positive for learning the fact that 54.6% of the students declared that they *always* or *frequently* searched the definitions of the key words from the title in dexonline (online explanatory dictionary) because they learnt in depth about the respective information, they solved certain misunderstandings, even though the accuracy of those definitions was not as good as in specialty dictionaries or in the encyclopaedic ones. Dexonline is more accessible and easier to use than the printed sources. These high percentages are relevant for the informed manner in which students prepared for writing a scientific paper. Students specified that they used printed sources less and thus 40.9% of the students searched *always* and *frequently*, while 45.5% searched *rarely* for the definitions of the key words from the title in printed specialty dictionaries, 22.7% of them *always* and *frequently* searched those key words in encyclopaedic dictionaries and 59.1% realised *rarely* that search.

(2) During searching for literature, 59.1% of them said that they *always* identified the key words from the title and 40.9% *frequently* did this. 43.5% of them pointed out that they *always* established a list of concepts that were related to their topic, and 47.8% did that *frequently*. Probably because they had to cope with certain problems, 68.2% of the students said that they *always* or *frequently* searched for the definitions of the key words from the title in dexonline, 52.2% searched those words in printed specialty dictionaries, and 31.8% of them did the search in encyclopaedic dictionaries. We noticed once again students' preference to use dexonline while searching web sources and disregarding searching those terms in printed dictionaries.

Procedures for searching web sources. In order to find web sources, 66.7% of the students *first* used the title of the topic in their search, maybe considering that they could find texts with the same title and to receive a shorter list of web sources. 25% of the students used the most relevant terms for their search, and 12.5% used key words from the title of their topic. Probably students noticed that the number of the identified web sources might increase in inverse proportion with the number of the words used simultaneously in their search.

Procedures if the search engine found on the web few/too many references. (1) When it found *few references*, 59.1% of the students said that they *always* chose new words for their search and that they *frequently* broadened their research topic. 50% of the students showed that they chose *frequently* to broaden the geographical area of the researched topic and to ask their professor. 45.4% of them *always* or *frequently* asked their colleagues and 45.5% asked them *rarely* in such situations.

(2) When the search engine found *too many web references* for a topic, students said they *always* or *frequently* sorted them according to the following criteria: trustfulness (95.8%), listing order (65.2%), last update (52.2%), number of positive comments (45.4%), number of visualisations (43.4%), and number of pages (31.8%). Students used qualitative screening criteria (trustfulness of the document, positive comments, last update), quantitative ones (number of visualisations, number of pages, number of positive comments), and hierarchy ones (listing order).

Procedures for visualising web sources/pages after their listing. After the listing of the available web sources for a certain topic, 52.2% of the students said that they *always* opened those pages selectively, and 23.8% *always* opened them in the order they were listed, while 47.6% did this *frequently*. This means that students used certain features of the listed sources in order to decide the manner they visualised them.

Procedures for a primary assessment of the information quality from web sources. Students answered that they used fast procedures for assessing texts. 66.7% of them *always* scanned the text, 56.5% *always* skimmed it, and 54.5% *always* or *frequently* browsed it. They said that they used also more complicated procedures for evaluating a text. Thus, 73.9% of the students argued that they *always* or *frequently* realised an in-depth analysis of a text, while 56.5% of them said that they *always* or *frequently* read it from the beginning to the end. Surely the same student used different procedures depending on the text.

Procedures students used if information from web sources seemed incorrect. If students suspected that information from web sources was incorrect, a frequent situation they had to cope with on the Internet, they used procedures for verifying information. 65.2% mentioned that they *always* searched for information in a series of web sources, not only in one. 43.5% declared that they *always* searched for and verified information in printed sources too, while 34.8% did that *frequently*. The fact that 69.6% *always* or *frequently* asked for their professors' opinion, in the Faculty of Geography, indicated a good student-professor communication and professors' strong ethos. We underline as a positive aspect the fact that 66.7% of the students *always* searched for information in trustful web sources, and in this way from the moment they started the search they diminished the risk to read or use incorrect information.

Procedures students used when finding a useful web source. 62.5% of them *always* downloaded it in their PC. 52.2% *frequently* took ideas from that source without downloading it. Surely each student used both procedures according to the features of the identified web sources. Because not all text type web sources with geographical content could be copied, we were interested to find out if that condition influenced students when using those sources. 75% of the students declared that they used text type Geography web sources that they could copy because they could select quotations to include in their paper, and 70.8% because they could use Google Translate if those texts were in a foreign language.

Procedures for preparing to quote web sources. To be able to quote from web sources, 66.7% of the students *always* copied the address of the web source in a list of references when they downloaded the source or when they took ideas. 43.5% of them *always* copied in a list of references the author's name or of the organisation in charge of the respective website at the moment of the download. 34.8% of them did this *frequently*. 43.4% of the students *always* wrote down the date when they accessed a necessary website when downloading the material or when taking ideas from it. 43.5% *always* or *frequently* used an inefficient procedure because they searched again for a certain reference on the Internet, using the title, in order to find its address when elaborating the list of references.

3.4. Analysis of the Criteria Students Observed While Searching Web Literature

The criteria for selecting the text type web sources that the search engine listed were the following, according to students' answers: the language of the text (87.5%), the abstract of the page (68.2%), the document type (word, pdf, ppt) (65.2%), requirement to register on a site, to have a user name and a password, and payment for accessing information (34.8%). The reason for the fact that 52.2% of the students selected *rarely* the text type listed web sources according to the requirement of registering on a site, of having a user name and a password, was that they did not like those strategies. 34.8% of the students mentioned that they *never* opened or looked at web sources that required payment, and 30.4% did that *rarely*. We underline that for Romanian students payment to access information is a difficult problem to solve.

The criteria for assessing how trustful was the information from web sources. 78.2% of the students considered *always* or *frequently* that there were not to be trusted the texts/information/files where the reference list or the author's name was missing, if the language was colloquial or literary and not scientific. 52.2% of them considered sources not to be trusted if there were not quotations in the text, 45.8% had the same opinion if the text was not structured using chapters, and 43.4% said the same if there was no mentioning of the date when the site was updated.

The language used for searching web sources. Taking into account the language in which the web sources were written, while searching web sources for a scientific paper, all students preferred to search first for sources in Romanian, this being the easiest way, but not necessarily the most valuable one scientifically. During their literature search, 91.7% *always* searched for sources in Romanian, while 8.3% did that *frequently*. We underline as a positive aspect that still, during literature search, they *frequently* (52.4%) and *always* (33.3%) looked for web sources in English. Only three students said that they searched for web sources in French, although professors recommended that they searched for Geography sources (especially statistical data, maps, charts, and photos) in diverse languages in order to do as good a quality search as possible.

3.5. Numerical Analysis of the Searched Sources

Taking into account the fact that students were required (or professors recommended them) to search for 10 sources, 54.1% of them indicated that they searched for more sources than the minimum necessary or the compulsory number and that was a positive aspect. 20.8% of them searched for more than 10 references, 20.8% searched for a larger number than the one the professor required, 12.5% searched for the double or triple number of references. 12.5% searched for the minimum number of references professors asked for. 33.3% of the students realised a minimal literature search: 25% searched for 6-10 references and 8.3% searched for 4-5 references.

4. Conclusions and Developments

We reached several conclusions and we underlined the most significant ones. Firstly, students searched for scientific literature using especially the Internet and having Google as their favourite search engine. They searched through diverse and trustful resources (website belonging to institutions and to researchers, to governmental data bases, etc.). At the same time, the respondents used searching and refining procedures.

Secondly, because of the abundance of online learning materials and due to the significance of their correct processing in order to write a scientific paper, research about students' abilities (e.g. analytic and critical thinking) as reviewers becomes important. Moreover, reviewers should also have a critical and constructive attitude about what they read and analyse. Geography students' knowledge about information processing techniques should be a topic for future research meant to identify weaknesses and gaps in their knowledge and enable us to plan future training courses.

To sum up, the respondents showed that they used the Internet while writing their scientific papers, that they appreciated its usefulness, and that they knew methods and techniques for searching the literature and for assessing it. Learning based on the Web is nowadays a continuous developing reality for which we should train our students.

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E-Communication, E-Teaching, Age and Gender

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Abstract

„The two words 'information' and 'communication' are often used interchangeably, but they signify quite different things. Information is giving out; communication is getting through." is Sydney J. Harris' opinion over what the process of communication involves.When one can fiind an environment that can make these two words merge, communication is complete, as it both gives out information and gets through to the receiver, from the 21st century perspective- and that is online communication. To approach yet communication from a complex perspective we need not forget about the non-verbal component that always completes the message to a greater extent than the verbal contribution, but that cannot be rendered complete in any type of environment. The following paper tackles the situation unfolded within a two year span process of initiating and building communication via Google educational tools , both within the teaching staff group specializying in communication and security and defense subject matter with some coming from foreign languages background, and within the classroom enviroment, in media communication course. A number of .... academic staff were involved, with a number of 50 students, attending both Bachelor and Master's degree program. Results of this study will be analyzed in the present paper.

Keywords: e-communication, e-teaching, google, education

1 Introduction

Using technology nowadays has become almost vernacular with generations to come. While plethora of writings have been issued on the skills and technological outbreak encompassing the 21st Century attitudes for the Net Gen or of the Digital Natives, the cohort of people born since the 80s now have children of their own, that go to kindergarten and are already skillfully taking screenshots or surfing the internet for the favourite song, game, cartoon on Youtube. Paces are faster than ever and scientists have been looking into the benefits and drawbacks of using technology at very early ages, particularly for the 2-3 year olds. Under these given circumstances and heading towards a society where human is less while artificial intelligence is more, one comes to wonder what happens to the older generations, the immigrants who are permanently trying to adapt, to change, to learn, to improve, as the set of skills that once gave them a job and status is no loner enough. Moreover, workplaces are no longer a „happily ever after" place to be, considering the permanent mobility, globalization and multicultural process of workforce migration. What is it there to be done in this framework? Adapt or peril is the simplest saying one can bring up. The present paper looks specifically at such a case where midaged educators had to shift geas to a certain extent, adapt to a new environment, with new requirements in terms of new working groups with new team work and collaboration skills, all encompassed by fostering new e-teaching and e-communication skills and attitudes. The educators' reaction and the whole adaptation process will be discussed here, compared to the reactions of students in their 20s, undergoing the process of being taught new tech skills as well. In the first case google ed apps were in focus of the training, while for the students' case, the Microsoft Office apps for media and communication were the training target.

2 Backgroud

A study performed by Samsung in 2013 showed that Romanian internet users go online 3,6 hours a day on average, especially to check their email, to be active on social networks and to communicate on the chat. The young people are yet leaders (the highest percentage) in terms of adopting technology. When speaking about online communication in Romania, studies revealed that 82% of the respondents use their mail, 68% use social media, 64% go to chat, 64% do research or get informed for school, work, while 61% get general, common information by reading the online newspapers. What all this information reveals to us is that the percentage of people using apps for accomplishing work –related tasks is not even mentioned, either for the fact that the figure is too low or for the fact that it was not representative for our country. However, the neeed for trainig work related skills is lover in young adults, who come equipped with most of the basic knowledge, coming from the Digital Natives generation, whereas the percentage of need goes higher with age.

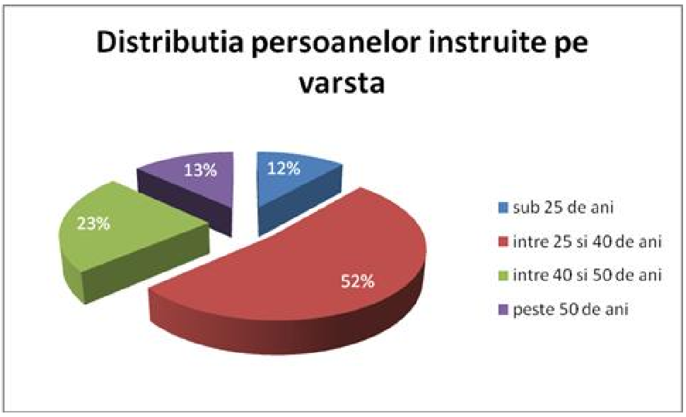


Fig. 1. **Iimagine showing the need for ITC skills trained for work related tasks, on age**

Apps for work-related tasks used at institutional level is not yet a subject for research or largely seen as important to be implemented and reported within the management process, even though the US has largely been laying great importance on apps-based managerial work recently.

When it comes to the educational field, there is no need to say that whereas technology changes the way the stakeholders interact with one another and since educators are the ones responsible for shaping both characters and skills to prepare students meet the demands of the labour market and of thier would-be employees, educators are the first to be upfront and master all the e-communication and information gathering and spreading skills in order to perform e-teaching at its best, in the context where the ones we teach are already ahead of us in managing e-communication and e-information.

While top managers mentain their e-communication startegy fresh (as it is revealed by a recent study), successful managers consider that effective communication lies at the heart of a successful business. Without being able to communicate, a team will have more difficulty accomplishing goals. Teaching is also a business and it can be successful if we manage to prepare our students for the ever demanding labour market. Yet, we have to prepare ourselves first, ahead of them, so that we have what to impart.

The study presented here shows a successful process a group of educators underwent wihin the Carol I National Defense University, Bucharest, Romania, within a period of two-year span, october 2013-october 2015. The subjects were both military and civilian academic staff. The target of the trening sessions organized each of the two years was to implement Google education applications in everyday work and communication, once our department obtained a number of email address accounts on the university domain *myunap,* from Google. Simultaneously, we will look at how first and second Bachelor students took up new skills helped by Microsoft Office, to foster communication and public relations skills. What these two processes have in common is building skills to communicate and inform, for educational, managerial and public relations purposes.

3 First training session

The first training was based on a general presentation delivered with a step by step demonstration into how to become familiar with the „myunap.net" accounts and inherent applications, meant for online communication. Also, for group management several account administrators were introduced to manage accounts for e-communication both for the educators and for the new students registration. Accounts for educators have been created and organized based on sub-departamental affiliation. Apaprt from getting used to accessing a job account that benefitted from other free Google educational applications, the trained staff also had to get used to initiating and maintaining email coordination conversations and group discussions with the students whose projects the above mentioned educators were supposed to coordinate. Moreover, initiations on Open Class and Open Class tutorial sites have been created for eduactors to take up applications that enhance collaboration, close cooperation and also project based learning along with interactive learning. At first, interest in all attempts was extremely low from the educators, otherwise interested in novelty related to teaching but reluctant to tech-use. Among motivations for their reluctance one could fiind disruption in internet connection, impediment of using their own laptops due to security policies imposed in our university, being a military university, also insufficent desktops inside our university , desktops connected to the internet, as well as self-labelling themselves as tech-immigrants, fear of competition or of getting lost within new territory of information, lack of motivation or inability to leave the confort zone. Telephone conversations and face-to-face communication was preferred over the ubiquitous e-communication, while for e-teaching the old xeroxed hard copy teaching handouts or lively group discussions and debates were prefferred.

Among the educational **Google apps** that the educators were intiated with were: the audio-video messaging allowng students and teachers were online to get connected for research papers cordination, the *Google calendar* that organisez classes, remnds its users of meetings, exams, announces the board of examiners and allows one to invite other people when creating the event. This happens paprt from synchronizing it all on the phone, so that a meeting recall can be signalled anywhere, anytime, to anybody and it can be made visible to anyone in a group, department, course. One can see his/ her colleagues agenda if that is also shared publicly and can know when his peers are available for other meetngs, breaks, other projects. In our trainees group, Google calendar was easily used by 10% of the initiated people, the others either considered the application redundant, others found it difficult to synchronize, while others pad problems creating events and inviting people to their generated event.

Google drive, on the other hand, posed difficultes to 75 % of the people in the trening, and those were the ones who were more dependent on attachments inside mails, the steps taken to sharing and uploading and even saving to different formats proved to be winding and showed no superior benefits to them compared to mail attachments. The all-beaten path of mail attachment seemed much easier for both sending, sharing and storing documents. The advantage of working online and saving changes simultaneously was outrun by the four activities of dounloading the attachment, working on it, saving and resending. Even though there were more steps to be taken, the staff found it easier due to the confort of the beaten track, compared to the uncertainty of accomplishing a new procedure to a satisfactory extent.

The part of the educators' group whose background was different before (switching fromm foreign languages to communication-related subject matter course teaching) were even more constant in aso avoiding e-teaching in the classroom or as assignments. With foreign languages teaching you can mostly use handouts and other teaching methodology that can easily avoid technology-based related tasks. Therefore, they all motivated lack of „need to know" resaons to take these skills over, and lack of motivation inherently.

The Open Class project inside the Google educational apps failed from the start in its implementation, irrespective of the advantages brought by student-student and sudent-teacher collaboration. A tutorial has been made and uploaded on the „sites" area, together with training in using the *google sites.* Application for creating spaces where students can fiind materials to study, extra bibliography, coursework, presentations from the classroom that they may have missed. This facility was taken by 20% of the educators and mostly used it to upload their presentatios from the class and bibliography for the exam, a presentation of the faculty was also made, an area for news and announcements but also area for daily academic schedules for each year of study and each program

4 Second training session

The second training session that took place in a context outside the place of work, in a summer school setting, in a completely different environment, in Mangalia, was based on learning by doing, so active learning was involved, learning in context. Communities of practice were organized throughout the process, to ease understanding of what is learned. Guided practice followed the input process. The approach was new and several apps were re-introduced simultaneoulsy. During this trainig more and more educators understood the necessity of using google calendar, google sites and google drive. Yet, most of the people in the group were relauctant still and also still more connected to using the realia.

This second training took place focusing on the most relauctant persons in the group, in a situated context, in a more pleasant environment, as previously mentioned. Workshops were organized for a whole week on the following topics:

- Using ICT to produce educational materials and to ease the didactic communication;
- Communication facilities for online didactic purposes;
- Online data sharing and exchange.

The sessions were all organized as active and integrative workshops where each participant laid hands on the computer, accessed the applications and performed tasks individually, while the trainer of that session was also performing the same task, that could be visualized on the screen, video-projected. The input sessions were followed by guided practice and then by group session where educators (trainees) had to aply what they were taught, to perform individual and unguided products, while at a later stage they had to explain the steps taken in performing the activity based on different google ed apps.

The results this time were far better. The educators gained more confidence from doing things on their own, at their own pace and confident nothing bad could happen. Coming back from the training the educators were more confident and are now using better and on a larger scale the google ed apps, while the number of the people who took up using these tools is far larger. The trainees realised that not using e-communication they create good ground for social isolation within the workplace, difficulty in gaining responses appears and miscommunication also leads to lagging in accomplishing work-related tasks. Even though the elements of non-verbal communication are extremely important and bring more value to a message, work management needs also time management and non-verbal communication is not compatible with e-communication. Non-verbal communication requires more more time, patience, empathy. In a very strict time frame this is not always possible so e-communication is the key to keeping smooth team work flow but also productivity going.

5 Combined and compared results

After having showed them trust and made the skeptical attitudes grow lower, the educators trainees were able to grasp more e-communication and e-teaching skills than in the first session where they were just observers. Reluctance of being able to perform everything on their own, reluctance of failure, had pushed all the trainees stay away from e-communication and e-teaching for one year and a half. Results of the second session of trening showed that the psychological factor is very important in teaching adults new skills, the environment and the manner of training.

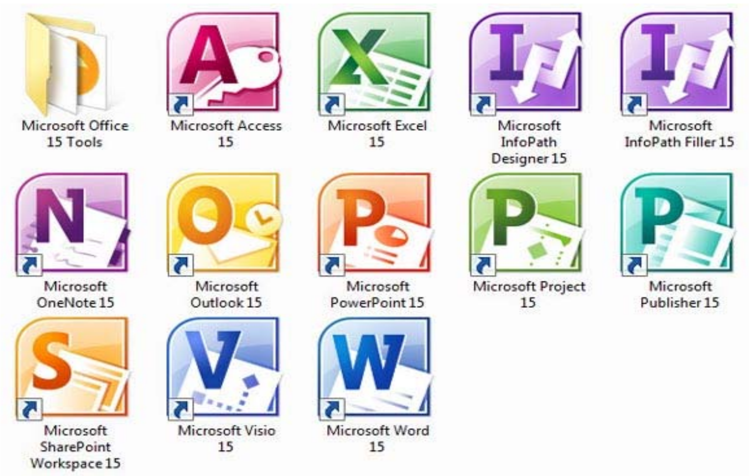
Age of the trainees triggers alterations of reactions, triggers a different need of approach, it triggers strong reasons to boost motivation and confidence so that the new knowledge can be easier transfered. With adults things are different in both knowledge transfer, rate of transfer, rate of success, efficiency and long term success of performace.

We should now look at the *Technology Acceptance Model* (TAM), more exactly at the the Perceived Usefulness (PU) defined by Fred Davis as "the degree to which a person believes that using a particular system would enhance his or her job performance", and at the *Perceived ease-of-use* (PEOU) which Davis defined as "the degree to which a person believes that using a particular system would be free from effort" (Davis 1989) (according the wikipedia definitions). With respect to the educators that underwent traning, *Perceived usefulness* (PU) was low after the first trainig session, due to the time of exposure to those apps and also due to the fact that situated learning and communities of practice had not been created. Moreover, the observation stage method they were subject to called for close to zero involvement. It is only in learning by doing that the involvement and immersion are deeper, enhancing for better setting in the learning mood and better knowledge transfer. Irrespective of the lecures and demonstrations given, due to the immersion factor that was low, the subject was not pychologically prepared for taking the information over, and consequently, without performing the tasks individually, the trainees could not see the proper usefulness of the applications, compared to the second training when, based on hands-on lessons and workshops, the perceived usefullness raised in all participants, in some from zero to 25%, in some from 25% to 50 % and in 50% of the trainees raised from 60 to 100%. Similarly, the Perceived Ease of Use factor (PEOU) grew from the first to the second session, it grew with the methods of instruction that were changed and improved, switching from simple observation to learning by doing and project based activities within situated context learning.. The ease of use was clearly improved as percepeption once the satisfaction of accomplished task was felt and the importance of the newly acquired skills could be transferred to real world environment. It is well known already that wth adults the motivation for learning is closely and directly linked to the extent the newly learned skill can be transfered and used into real world working environments. The larger the extent of use in the real environment, the greater the motivation to apprehend the new notions. Women were present as 80% of the group in focus, and women were more determined to take up the new skills, compared to men who were more easily offended and that made them hard to admit failure is part of the game.

6 The students' case study

The case study that involved students in the bachelor degree program, communication, media and journalism, looked at the easiness of perception among the 20 year olds in getting familiar with new Microsoft Office or Open Educational Resource (OER) tools to assist in the production of public relation and communication outputs. The case study unfolded on a period of two years also, with students in first and second year of the bachelor degree. All needed very low input in the process of taking up the usage of the tools : *powerpoint* (movement effects and insertion of audio video materials, transitions and special image effects), *publisher* to create brochures, magazines, leaflets and posters and *movie maker* to turn collages of images into short mp4 movies with sound incorporated. Also, we used OER as resources to learn how to build websites and web pages and blogs.

The conclusions triggered from the students' case study are totally different from the adults' training sessions. The 19-20 year olds were more receptive, more open to learning new skills and among them, girls were more patient and creative than boys, more skilled due to their patience and more productive overall. The first year students that underwent trainig were yet less motivated to learning new skills for their future jobs, compared to the second year students who were one year closer to graduation and few months away from their internships, where they obviously were about to use the already acquired skills.



Also judging the products they accomplished for the public relations and media communication courses we might say the outputs were more complex, more imaginative and more adapted to the labour market requirements with second year students than the ones prodced by the first year students. Here is not the the case of factors like PU or PEOU. The results can easily be linked to the degree of maturity and involvement, commitment to the class and to preparing for future jobs. The perceived usefulness factor does not apply to Net Gen students who see each and every computer related tool as something already inherently natural for daily life. These students grew with computers, have been surfing the internet on any terminal irrespective of its dimension and for any purpose they have, are complex-free in desciphering any new application and stress free from taking up any IT related skill when it comes to operating, producing and giving out information, to communicating, expressing themselves or situating themselves socially.

Conclusions

At the end of these two case studies we concluded that when found in learning contexts, older adults, compared to younger ones, are often more reluctant to engage in new skill training and tend to prefer collaborative (versus competitive) tasks. Explanations of these phenomena based on the level of input (we should mention here self-efficacy, a highly effective predictor of students' motivation and learning, a performance-based measure of perceived capability,and the extent or strength of one's belief in one's own ability to complete tasks and reach goals, according to Bandura (1977)) refer to the importance of age-related changes on changes within one's motivation to take up new skills. Explanations can be founf in the research on the dynamics of adult development in cognition, emotion, personality, and the self and the elements that affect psychological variables involved in motivation new skill uptake.. The older the age, the lower the dynamics of learning stirring from lower perspective on time, life expectancy or opportunities expectancy.

Our conclusions are in line with Wechsler (1944) who indicated a gradual decline in cognitive abilities over the life span, particularly those associated with fluid intelligence (fluid intellectual abilities that are most associated with working memory, abstract reasoning, attention, and processing of novel information. Although there is some controversy about the exact age when this peaks, the typical research finding is that maximum levels of this fluid intelligence are usually reached in the early twenties (Schaie, 1996) That is why our bachelor students had a much better uptake in skills, not to mentioned the two different types in generational approach to IT use. Therefore, new skills are better taken up at as early as posibble an age, whereas in the cases imposed by labour force migration, changes of domain and field of work, re-skilling and re-placement on the labour force market needs to be done in carefully prepared contexts, conducive learning environments and with timely prepared stages of learning, as the older the adults the more complex and demanding the knowledge transfer is.

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Blended learning at Universities

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Abstract

In the era of modern technology we are faced with the fact that educational institutions shall be included in the process of modernization of teaching. This would itself provide an opportunity to easily move over to e-learning. In concept blended learning students are in center of teaching process and they are creating its dynamics. This concept of learning is between on-line learning and traditional learning. Students learn through online delivery of content, but just partly. The goal of this paper is to show the difference between traditional and blended learning on universities and to highlight benefits of blended learning.

Keywords: student, traditional education, online contents, blended learning

1. Introduction

By incorporating information – communication technologies in teaching and learning has occurred in all sectors of education. Information – communication technologies offer new opportunities but also new challenges for teachers and for students “ (Redmond, 2011) ”. Number of courses and content that students are offered over the Internet is constantly growing, and as a consequence has a strong influence on the changes that occur in the traditional concept of learning (so, the concept of face-to-face). If you need innovation and change in university teaching – such as new technologies and industry knowledge required, and as students look for, then it follows that teachers must take the role of researchers and teaching “(Laurillard, 2002)”.

Most authors agree that the use of online teaching and online content, which is a welcome change, but however, inevitably raises the question of effectiveness and efficiency of the teaching process. The concept that incorporates elements of online and traditional concept of teaching is a mixed learning – Blended Learning. Mixed learning is a kind of learning environment that combines the advantages offered by learning with the help of computers on the Internet and traditional learning “(Osguthorpe and Graham, 2003) ”.

In this paper, we investigate and identify the common characteristics between the mixed and the traditional concept of teaching and learning and analyze the differences between them. Further research, with the observation mentioned similarities and differences will show the advantages of the concept of blended learning, but also less positive side of this concept. Also we review one blended learning case in Iran higher education.

2. Common features and mixed traditional concept of teaching and learning

Technology is the first common characteristic mixed and the traditional concept of teaching and learning. This at first glance may seem contradictory, but a large number of online and offline multimedia content can be found in traditional concept. Technology is not the exclusive privilege of online or blended concept of teaching and learning as such “(Comer and Lenaghan, 2012)”. Blackboard and chalk in the hands of professors can be found, in addition to the traditional and mixed concept. Traditionally learning environment is no longer free environment technology, and digital technologies in a variety of formats are available in an environment where the students face to face with the teacher, not necessarily converting this environment in an online environment “(Mayer, 2001)”.

The next common feature of the classroom, which retains its classic features space for learning and teaching, but, in the context of blended learning, observes a broader - as a learning environment. The concept of the traditional classroom is being developed to include new functions and how these functions beyond, so does the potential for using new and innovative methods of learning based on modern technological achievements “(Brown and Lippincott, 2003)”. The other "spaces", such as trips, field trips, visits to specialists, can be, so to speak, transformed into classrooms that are modern environment for learning and performing the teaching process.

The latest potentially most important common characteristic of these concepts is a professor, who create an environment and atmosphere that suit his/her lecture. Whether the professor will ask with authority and leadership, or will insist on team spirit to the role of facilitator of the learning process, is solely within the competence of the professor and his assessment of how the material will be better mastered. In both the concept of learning is possible that positively and negatively affect the motivation, easy and mutual competition of students. The role of the professor to find the best modus operandi that will bring the best results of the learning process, which is certainly regardless of whether it comes to the concept of traditional or blended learning.

3. Differences of mixed and traditional concept of teaching and learning

Although at first glance it seems that between these two concepts there are only a few differences, in practice proved otherwise. First of all, the traditional concept of the student's specific place and time of teaching, and the teacher is the one who determines the speed at which the material exceed, in the concept of a mixed situation is much more flexible and all, to a greater extent, adapted to the needs and abilities of students. When blended concept emphasizes the possibility of concept documents and materials at any time, while the traditional is only when a professor gives a lecture “(Jeffrey, 2014)”. The difference can be observed when looking at the costs borne by students. In the traditional concept of the costs require leaving and returning from lectures, time spent for travel, parking and the like, while the mixed concept can significantly reduce these costs. Differences in the learning process, in the strict sense, are shown in the table below “(Online vs. Face-to-Face Learning) ”.

Table1. **Differences in learning process concepts**

Traditional concept	Blended concept
Students with lower self-esteem does not participate or rarely participate in discussions	Allows students with lower self-esteem active participation
Interaction with other people at the university reduces the percentage of withdrawal from the study	If mixed concept is closer online access to students likely to leave the study due to lack of contact with other people at the university and/or due to technical problems
Discussing about the subject matter is limited in time	Discussing about the subject matter is not time-limited
All questions in connection with the material may be solved during the lectures	Uncertainties can not be immediately discussed, which can lead to severe Studying
Professor is the one who fully managed classes	The student is placed in the center of the teaching process

4. Advantages and disadvantages of mixed learning

How the concept of blended learning did have a number of different forms, it is not easy to determine the precise advantages and disadvantages. If we start from the general elements of blended learning, the advantages and disadvantages of this concept can be summarized as follows:

Benefits:

1. Interaction and communication - Level interaction, the speed and scope of communication between teachers and students is significantly increased.

2. Flexibility of use - Students have more time flexibility for solving the tasks set, where they will meet their obligations in a time frame, and not in a defined period. In addition to the temporal and spatial dimension is an important positive factor because tasks can be performed from any place where a student has access to the interface that is used "(Graham, 2006)".

3. The availability of materials - Availability of material that is essential to the courses is one of the key components of blended learning. Lectures which may be broadcast live over the Internet or recorded and reviewed later, e-books, e-libraries, and other materials are available to students at any place and any time.

4. Costs of study - In most cases, the tuition fees for the degree program lower on studies blended learning than in study programs with the traditional concept of learning. In addition to tuition and fees, the advantage may be, mentioned above, reducing the cost of transport and accommodation depending on which way it is implemented the concept of blended learning "(McGee and Reis, 2012)".

5. Quality - Convenience and mobility of this concept study provides a quick and easy learning environment "(Farahiza et al, 2010)" which has proven to be less stressful for students and leads to better results. Furthermore, according to the experience of some professors mixed learning has led to improvements in student papers and discussions.

Disadvantages:

1. Infrastructure - To a mixed learning fulfilled its purpose, there must be quality information - communications support that will maintain the online segment of the system to a mixed learning. In addition to this support, the lack of quality hardware and software has played a significant role in reducing the advantages of blended learning over the traditional concept "(Graham, 2013)". The big problem can be slow and limited Internet access, which implies a need for special equipment to improve the flow of information.

2. The initial costs - initial cost of introducing blended learning and setting up a complete infrastructure can be prohibitive. The gradual introduction of online elements can be a solution to the problem of high initial costs. Furthermore, the perception of students that is free as it is in electronic form is a definite drawback. It was also proved that students are less willing to pay for online materials compared to those in the printed edition "(Ross et al, 2013)".

3. Quality - Difficulty adoption of new methods and techniques in the transfer of knowledge from the professor presents a significant obstacle to the introduction of the concept of blended learning. The development of new learning requires a lot of effort and work of the teaching staff. Online materials do not constitute a simple power point presentation that will be distributed to students via the website, but a whole set of different materials, which should lead students through individual learning process which partially exclude direct contact with teachers.

5. Case study: blended learning in Iran

To elaborate the concept of blended learning and its experiences, one case of Blended learning in Iran has been reviewed. In this case Blended Learning was defined as a "hybrid of traditional face-to-face and online learning so that instruction occurs both in the classroom and online, and where the online component becomes a natural extension of traditional classroom learning. Blended learning is thus a flexible approach to course design that supports the blending of different times and places for learning, offering some of the conveniences of fully online courses without the complete loss of face-to-face contact" "(Colis and Moonen, 2001)".

In the past 20 years, Iran has relied on a knowledge-based economy and Information and Communications Technology (ICT). According to development programs of the country, valuable financial activities and national income sources include knowledge, skill and efficient workforce. A key component in a knowledge-based economy is knowledge and skills of citizens as to provide professional requirements of the society. In this respect, development and preparation for new educational settings that mainly have up-to-date technologies is necessary.

In 2003, Mehr Alborz, a non-governmental university, was founded with the aim to train and transform students to become professionals in the workplace. Mehr Alborz aims to expand its presence and further develop its education base by offering e-learning in blended learning format "(Mehr Alborz University (MAU) Website, 2015)".

The clear differences between a university that provides education in an online environment and traditional universities are the quality of education delivery, pace of development and enhancing the learning process. In fact a virtual university like Mehr Alborz, *not only* is capable of presenting varied programs along with high educational standards, a desirable quality and availability but also can ensure availability regardless of time and place with a special level of influence and an outstanding increase in easy access to educational services.

Mehr Alborz University (MAU) tried to respond a large part of demands for higher education in the country with the use of highest capacity and capability and also attempts to train workforce for future Iranian knowledge-based society. The Consideration of ICT as the centre of MAU makes sure that the alumni create more new occupations and provide the society with its important need for professionally skilled technicians of many management and ICT fields in private and governmental institutions.

In 2005, after years of research work and study, the university received final confirmation of higher education development council of Science, Research and Technology Ministry and Mehr Alborz University was established.

The university's mandate and internal policies were ratified by higher education development council in a session on April 8th 2006. MAU began its activity as the first virtual non-governmental higher education institution of Islamic Republic of Iran and combined classic face to face learning by e-learning.

The principal goal of the university is to offer a reasonable education pattern by way of applying world standards in education programs through experienced and knowledgeable professors, most qualified virtual content and most efficient e-learning system that meets Iranian culture "(Mehr Alborz University (MAU) Website, 2015)".

In MAU pedagogy model that is based blended learning, three components are working, *1) Digital Content which captured by instructor and available in LMS (learning Management System) on 24/7 to students. 2) Virtual Class which connect virtually instructor and students on the fixed times by Adobe Session. 3) Face to face class which be held at the first, middle and end of semester.*

Now MAU has more than 1500 students in 13 master programs and ranked as a fist e-leaning university of Middle East and cane be bench marked for developing blended learning in universities.

6. Conclusion

Teaching and learning is an evolutionary process that began with a classroom, chalk and blackboard and reached the completely digitalize online environment. The concept of mixed learning is more prevalent at higher education institutions through the use of new information - communication technologies. While blended learning can be more effective than face to face and more engaging than online alone, the efficiency of blended learning can be hurt by a tendency to simply add asynchronous activities to on-campus courses rather than intentionally re-design courses when they become blended "(Means et al., 2010)". Indeed, blending often increases workload for both instructors and learners; the course-and-a-half phenomenon reflects what many learners dislike about blended courses… too much work "(McGee and Reis, 2012)". On the other hand, one of the traits of successful online educators is that they spend more time than do less successful online educators in the design and delivery of their courses "(Vu & Fadde, 2012)". Most of researches show that respondents expected a dramatic rise in using of blended learning approaches in higher education in the coming years. According to the authors, the essential question is not whether the concept of blended learning is to be introduced to higher education institutions, but which is the best way to implement this process.

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A Hierarchical Model of Test Generation within a Battery of Tests

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Abstract

A new way of learning is used on a large scale, because online tests combine technology with learning, bringing a high level of practicability and efficiency. A lot of web applications contain batteries of tests used for preparing the students in various domains. A battery of tests contains a number of tests which have different levels of difficulty and are related to each other. This paper presents a modality of generating tests randomly for the subsequent levels of difficulty, complying with certain restrictions regarding the dependence between tests and the different levels of difficulty within a battery of tests.

Keywords: e-learning, battery, test, random, tree

1 Introduction

The technology became present more and more in everyday life and we have to assimilate more and more information in order to keep up with the environment. This is the reason for which we have to learn from the technology secrets and the way in which it should be used to make our life easier.

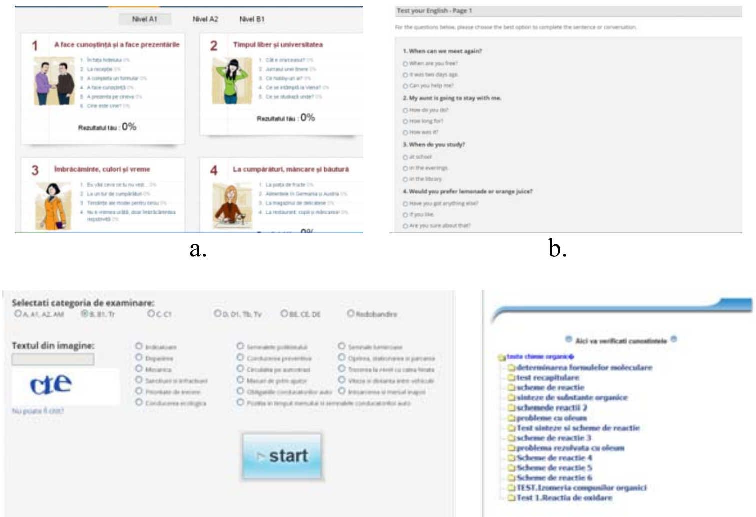
Although, in the past, learning meant buying books, manuals and their reading replied to almost all the problems, these are not sufficient nowadays. Not knowing how to use a computer and its mechanism is not very good. The occurrence of billions of websites, social networks, information in real time from almost anywhere on the globe impetuously led to the development of the society. Nowadays, even the most usual calculi evolved in more and more sophisticated software which requires much knowledge. The computer became indispensable even in school environment and the tests made for verifying the assimilation of knowledge in a certain domain or for other purposes are present more and more online, at a distance of a mouse click. They are necessary because they help the student to verify their knowledge before other important exams.

We choose this issue because the online tests are growing in importance and an organization on levels of difficulty is easing the process of learning. Also, we choose a random algorithm because the usage of this method is very efficient. This method can be also used in other environments, such as for the organization of a website (the sitemap), the pages being situated at different levels.

Section 2 of this paper will present general data about online tests and research made on the theme. In section 3, we will shortly discuss about trees and problems solved used these structures and section 4 will contain a couple of paragraphs about random algorithms. Section 5 will describe the algorithm made for this paper, of generating "paths" of tests within a tests battery. We will present some specific results and discussions about the implementation of an algorithm on a simple particular instance and we will show the efficiency of the random algorithm in section 6, followed by some conclusions, future work and references in section 7.

2 About online tests

Online tests represent an alternative to the classical education, which is made in order for the students to find various methods for assimilating the information easier. Useful information about test items can be found in paper [2]. There are various types of online tests, starting from general knowledge or driving ones to intelligence tests (detailed in [1]) or tests which help at self-cognition. The paper presents the modality of generating randomly a “path” of tests from an initial easy test to a final harder test using notions related to trees theory and random methods. This is a method which helps the student to pass through different levels of difficulty, in a specific domain. In Figure 1 there can be observed some instances of online tests.



a. b.

c. d.

Figure 1. **Different types of online tests [6, 7, 8, 9, 10]**

There were studies made in order to show the importance of online tests in learning, presented in paper [14], and comparisons between types of learning, as well as online learning, such as in papers [17] and [21].

3 Trees and graph theory

Graph theory has evolved more and more. Studies and books have been written about their applications in practice. With direct results in various domains of life (transport, chemistry, management, system models, in particular, decision trees – studied in detail in papers [11] and [15] - etc.), graphs have proven their practical side. Trees are a particular case of graphs. A tree is an undirected graph with no cycles. We can say that tree proprieties can be found in nature. Trees notions are used in various domains (e.g. searching trees, studied in the book [2], web applications, as shown in paper [20]) and many studies and books study these notions (such as in the book [3]) in order to find out solutions to other problems based on tree proprieties, detailed in paper [4].

4 Random algorithms

Because of their large applicability in practical problems, random algorithms are widely spread in solving problems, due to their runtime which is far better than classical algorithms with an exponential complexity (in domains such as networking - [16] - or other structures in mathematics - [18], [19] - in organization matters, such as the generation of a schedule, in paper [5]). The disadvantage of a probabilistic and possibly less accurate solution is preferred in the detriment of a much more favorable runtime [11]. In this matter, a great deal of research on this issue has been made along the years.

5 Description of the algorithm

Test generation within a battery of tests is a useful task within the build of a web application of this kind. This task can be accomplished using notions regarding trees and the methods of their traversal. In this section we will present the input data we need, the structures we will use and what it will be output in order to generate the subtree that solves the issue.

The problem can be described in this manner: we have a number of tests within a battery of tests. These are organized on levels of difficulty. In order to "pass" the battery of tests, the user must move to the next level by solving the test on the present level. In other words, the test from level i must be solved in order to move to the j level (i=j+1). The algorithm generates randomly "paths" from the first test to the final test, which means that, at every level, a test within that level is randomly chosen. The first test is considered "the root" and the final test is a leaf of the tree.

Input data consists from the number of links or edges between nodes (m, which is the number of nodes in the tree minus 1) and the relations between them, on m lines, in pairs. For example, the line k contains a pair of numbers/nodes (i,j), where i is the parent node of j. Based on this form, we will later build the array of parent nodes.

Regarding the structures used for the algorithm, the next list present them:

- n (integer value, which represents the number of nodes in the tree/the number of tests, equal to m+1)
- T[n] (integer array, representing the array of parent nodes). It has the next significance:

$$T[i] = j, where\ j\ is\ the\ father\ node\ of\ i; (j = \overline{0,n};\ i = \overline{1,n});\ T[root] = 0;$$

- LEVEL (integer value – the number of levels in the tree)
- sol[LEVEL] (integer array which stores the nodes of the generated subtree)

The tests are codified with numbers from 1 to n and the levels of difficulty are denoted by 1 to LEVEL, where 1 is the easiest level and LEVEL is the hardest one. Every test is associated to a difficulty set before reading. LEVEL is calculated recursively within the random function.

The algorithm uses some methods for preparing the data needed for generating the subtree. These methods are:

- the built of the parent nodes array (T)
- the random function, which builds the solution array and, implicitly, the subtree of tests

As an observation before describing the algorithm, we can say that two cases can be possible within the problem, regarding to the root:

1. there is a single initial test (a single root in the tree);
2. there are more initial tests (multiple roots).

The first case is studied in detail in this paper. The second case is a particular case of the first and it can be solved simply by creating an imaginary root for all the initial tests, which will help in generating starting from the first level and which will not be part of the generated subtree. Figure 2 will graphically show what happens in this case.

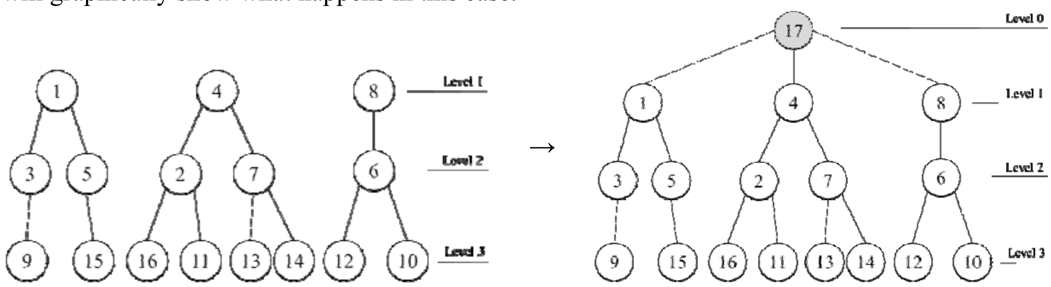


Figure 2. **Solving the case with multiple initial tests**

Practically, the algorithm follows the next pattern:

Step 1. Read data from file, pairs of numbers (i,j), i,j=1,n.

Step 2. The tree is built in the form of parent nodes array based on the data read at step 1. For every pair *(i,j)* read at step 1, *T[j]=i*, i,j=1,n.

Step 3. The random generation of nodes in the tree is made. Here, we have two substeps:

Step 3a. The current node is verified if it is a leaf node. The pseudo-code is presented lower, in bold characters.

Step 3b. If the current node is not a leaf, based on step 3a, then the generation goes on. Otherwise, it is passed at step 4.

A recursive function is used with one parameter which is the path length (or the current level). Schematically, the random function can be presented in the next form:

```
sw←0
for i=1,n do
        if T[i]=sol[k-1] then
                sw←1
                break
        endif
if sw←1 then
        do
                sw←1
                x←1+rand()%n
                if T[x] ≠ sol[k-1] then
                        sw←1
        while sw=0
        sol[k]←x
        LEVEL←k
        random(k+1)
endif
```

It can be observed that the generation starts from the second test (the call of the function is random(2)), given the fact that the root cannot have a parent. The root is generated differently, before the actual generation begins.

Step 4. The array *sol* is output, containing the subtree that respects the conditions stated in the beginning.

6 Example and results

We will take an example in the next rows. As input data, we have:

For example, we will consider a battery of tests with 26 components. It corresponds with a tree with 26 nodes and 25 edges (according to the definition of trees).The scheme of the tree is presented in Figure 3.

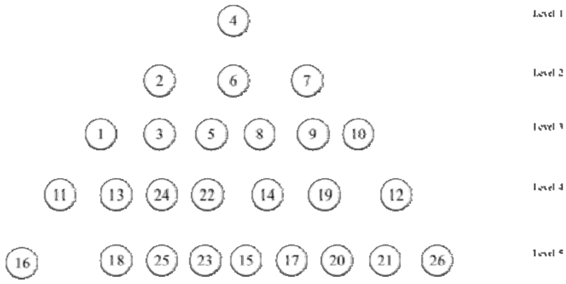


Figure 3. **The tree from the example**

The array of parents has the next form:

$$T = (2, 4, 2, 0, 6, 4, 4, 6, 7, 7, 1, 10, 1, 8, 14, 11, 14, 13, 9, 19, 12, 5, 22, 3, 24, 12)$$

The algorithm searches then the root. In our case, the root (the initial test) is the node 4 and, therefore, it is selected. Then, numbers from 1 to 26 are generated.

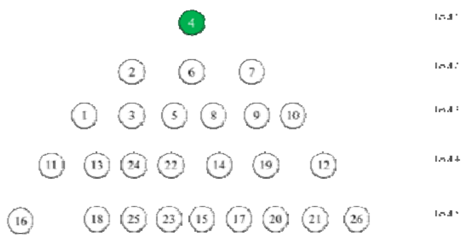
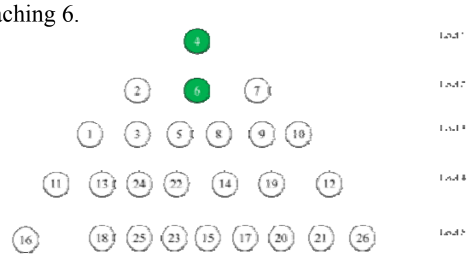
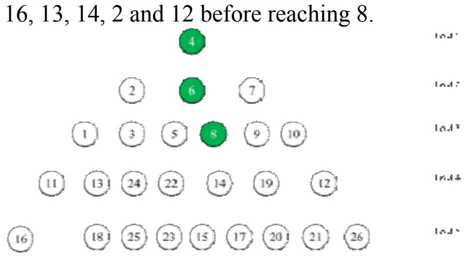
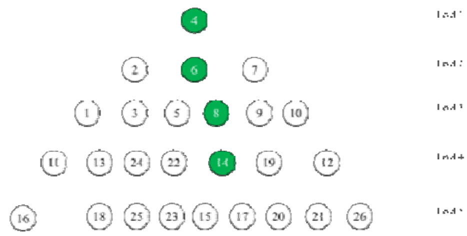
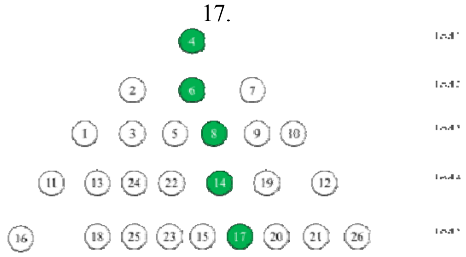
<table>
<tr>
<td>The root 4 is selected.

sol = (4, 0, 0, 0, 0)
The next nodes can be 2, 6 or 7.
Node 4 is verified to have or not children → 1.</td>
<td>There were generated 17, 18, 1 and 12 before reaching 6.

sol = (4, 6, 0, 0, 0)
The next nodes can be 5 or 8.
Node 6 is verified to have or not children → 1.</td>
</tr>
<tr>
<td>There were generated numbers 17 16 13, 17, 18, 25, 14, 9, 17, 22, 1, 18, 26, 11, 7, 2, 16, 18, 12, 26, 16, 13, 14, 2 and 12 before reaching 8.

sol = (4, 6, 8, 0, 0)
The next node can be 14.
Node 8 is verified to have or not children → 1.</td>
<td>There were generated numbers 16, 19, 24, 24, 19, 17, 19, 9, 5, 10, 7, 7, 24, 8, 6, 3, 6, 2, 7, 13, 11 and 24 before reaching 14.

sol = (4, 6, 8, 14, 0)
The next nodes can be 15 or 17.
Node 14 is verified to have or not children → 1.</td>
</tr>
<tr>
<td colspan="2">There were generated numbers 19, 2, 1, 26, 12, 23, 2, 23, 24, 12, 12, 9, 13, 13, 10, 13, 12 and 3 before 17.

sol = (4, 6, 8, 14, 17)
Node 17 is verified to have or not children → 0. The algorithm finishes.</td>
</tr>
</table>

Figure 4. **The algorithm progress for the example**

As for the runtime for different values of nodes, we can present the next graph:

25 (m=n-1)	2 3	1 13	14 17	11 16
4 2	6 5	3 24	9 19	12 26
4 6	6 8	5 22	10 12	13 18
4 7	7 9	22 23	19 20	
2 1	7 10	8 14	12 21	
	1 11	14 15	24 25	

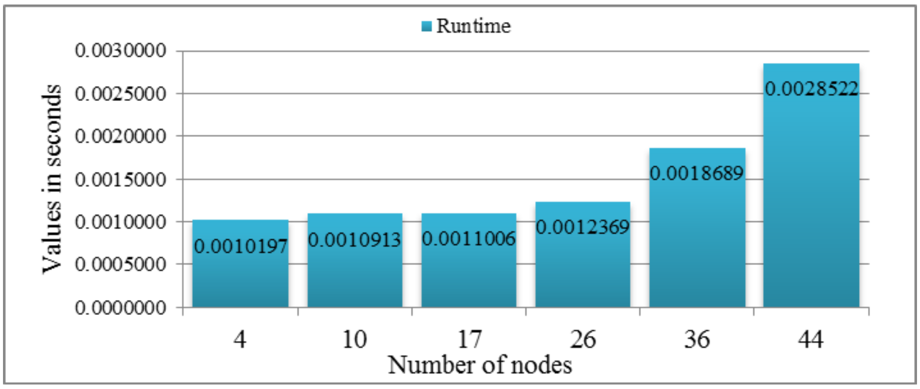


Figure 5. **Values of runtime (nanoseconds) for different number of nodes (n)**

The number of nodes was chosen in the way in which a new level is formed. For example, at n=4 the tree has 2 levels, at n=10 the tree has 3 levels etc. The values in the graph are presented in nanoseconds. We can observe the runtime increases, but with a very minor difference between values (1 nanosecond=10^{-9} seconds, which means the difference consist in thousandths of a second or tenths of thousands of a second), while the number of nodes increases in a greater pace.

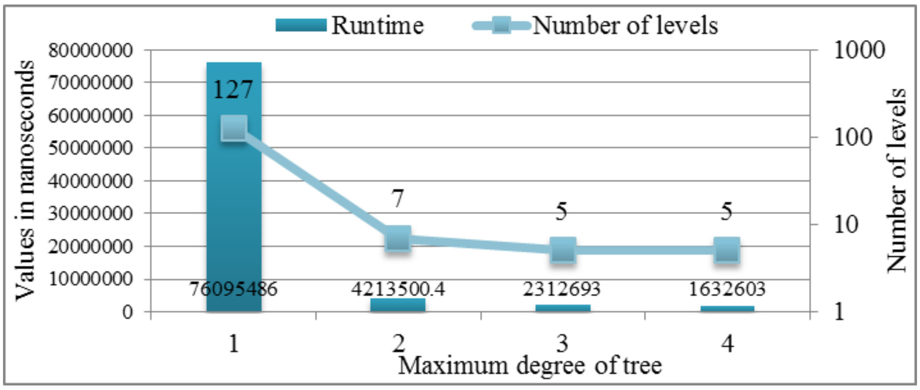


Figure 6. **Values of runtime depending on the tree ramification**

As it can be seen, for the same value n=127, we obtained three values of runtime. The difference consists in the ramification (the degree) of the tree. In the first case, every node has one single child (the tree degree is 1), the runtime is the biggest. For the other cases, the maximum degree is 2, 3 and, respectively, 4 (which means that the maximum number of nodes a parent has is 2, 3 or 4).

7 Conclusions

The method presented in this paper is a useful one within a battery of tests, as well as for other structures (such as a website map). A future work for this paper would be the development of an online application (with a certain number of batteries of tests) and the random generation of tests within a battery of tests, using web programming languages.

As we can see, the e-learning is an important part of a student learning environment nowadays. It may have certain advantages, but these types of new methods of learning must be combined with the traditional ones, neither of them having results at their own. The combination between them brings benefits to the intellectual development of the students and a faster and better learning.

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Data gathering algorithms for wireless and analogic sensors

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Abstract

The paper presents a console application based on data gathering algorithm for wireless sensors. The paper presents also a serial port monitoring console application, for reading the signals from physical world (temperature, humidity) by using electronic devices, for highlight the advantages of using wireless sensors. For serial monitoring was used the FTDI device which allow to send the electrical signal and transform in digital one, and for wireless monitoring was used a Bluetooth device. Software programming is made by using C programming language.

Keywords: algorithm, monitoring, signals, wirelles, sensors

1 Introduction

Wireless sensor networks provide for researchers a lerge number of applications with potential for target detection and tracking, environmental monitoring, industrial process monitoring, and tactical systems (Demirkol et al., 2006).

The processors and microelectronics areas developement enable also development of distributed network of nodes which are capable of sensing, computing and wireless communication. The resources of the sensors for computing in a strong relation with energy constraints. In a network distribution the sensors execute operation of gathering and transmission of sensed data to a base station for further processing (Khan et al. 2013).

The action of gathering data from sensors by using energy efficency requirements needs optimization for power necessary for gathering in sensor information systems by using optimal chain-based protocol that minimizes energy (Marin, 2012). The compressive data gathering can reduce global scale communication cost without introducing intensive computation or complicated transmission control (Haykin and Liu, 2009). The capacity of the network sensors under this many-to-one data gathering scenario is reduced compared to random one-to-one communication due to point traffic concentration at the data collector/receiver (Kalpakis et al., 2003). Data gathering schemes can minimize the energy and delay cost, as measured by energy*delay (Lindsey et al., 2012).

For wireless sensor networks, mobile elements are built into the system to improve the lifetime of the network, and act as mechanical carriers of data. The mobile element controlled visits the nodes to collect their data before their buffers are full (Luo et al., 2009). The data gathering for large scale wireless sensor networks can be ensured by introducing mobility into the network. A mobile data collector (M-collector) could be a mobile robot or a vehicle equipped with a powerful transceiver and battery, gathering data while moving through the field (Somasundara et al., 2004, Ma et Yang, 2007).

By using topology it is possible to design an energy efficient data gathering protocol. Cluster architecture is an effective architecture for data gathering in wireless sensor networks (Duarte-Melo and Liu, 2003, Liu et al., 2007). For scalability in wireless sensors network the nodes are grouped into disjoint and mostly non overlapping clusters (Abbasi and Younis, 2007).

2 Software development

The serial port monitoring console application Sense for reading the signals from physical world (temperature, humidity) by mainboard and sensors was made by using C programming language. The result of running Sense program are displayed in a Serial Monitor windows (figure 1). For using the Sense software the user will select the port from combobox list and the sensor or sensors for which will do the reading (figure 2). Data tracked from sensor will be displayed in a view form (figure 3a). Data can be saved in txt file (figure 3b), cvs file or can be stored in database. For serial monitoring was used the FTDI device which allow to send the electrical signal and transform in digital one.

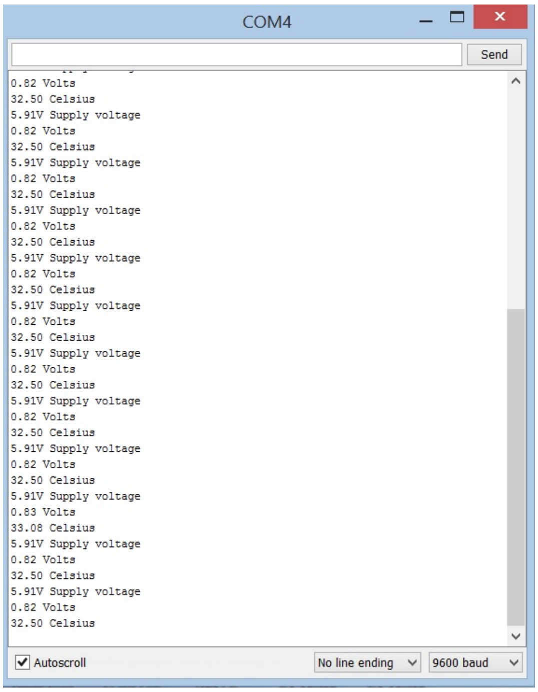
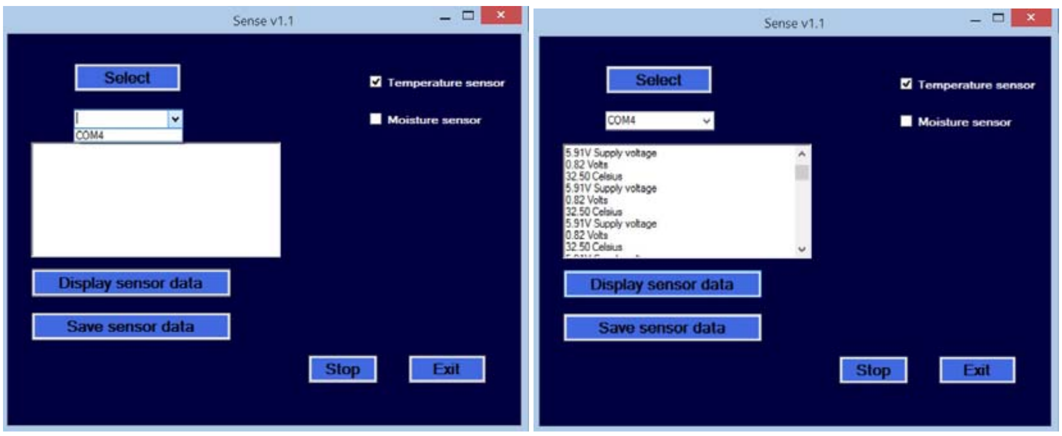


Figure 1. **Serial monitoring**



a. b.

Figure 2. **Software Sense v1.1 – data view**

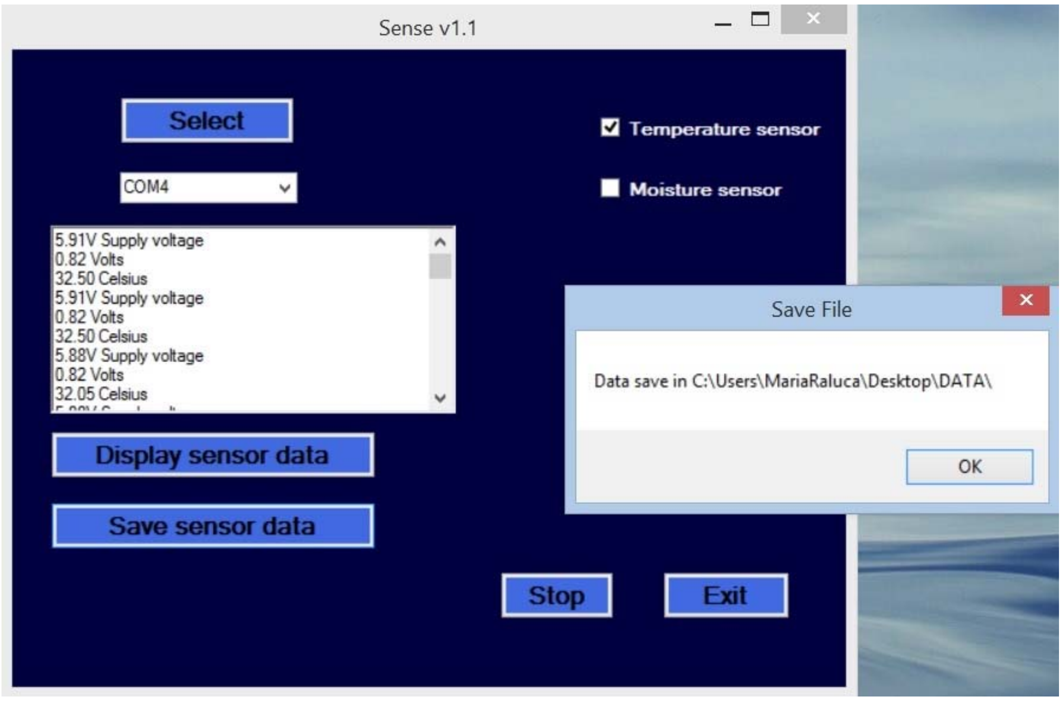


Figure 3. **Software Sense v1.1 – data save**

For saving data from sensor in database is required to modify delay(1000) which means 1 second to 30 seconds, delay(30000) in software for initialization motherboard.

For for wireless monitoring was used a Bluetooth device. For send data wireless from to aggregators (phone, notebook, tablets) it is requered to upload on moatherboard the software which initializes the Bluetooth device. The using wireless communication allow to save data directly in database or in cloud.

The method data centric-storage (DCS) used for storage wireless sensors networks can facilitate data aggregation in a distributed way (Khandakar and Gregory, 2013).

3 Conclusions

The serial monitoring has the disadvantage of requiring the use of a USB cable and data are stored in CVS format file or database and then can be stored in the cloud. By using wireless transmission is possible to save directly in the cloud or database.

Gathering data from a network composed by n nodes (sensors) it is required to use clustering algorithms and wireless communication.

The data volume gathered from network sensors is huge and for this reason it is required to use wireless systems.

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Mathematics with Scratch

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Abstract

Goal of paper is to illustrate how can teach mathematics through ICT programming for primary school students using Scratch. The means used are observing and conducting simple experiments supplemented by modelling the experiments on computer. Content of this paper is derived from experiences with Scratch Software for "Recognition of the geometric figures and theirs properties in near environment". This lesson is in Romanian national curriculum for third grade, on discipline Mathematics. It knows that the multimedia resources stimulate audio-visual memory, transpose the students in the middle of the Phenomena and complement their knowledge in a likable manner. But the ICT during the class can induce a bored. By involving students to design themselves modelling of experiments on tablet or computer we can win eliminating the monotony, formation of analytical thinking, training programming skills in an enjoyable manner through specialized software for their age. My paper depicts the lesson plan for lesson" Recognition of the geometric figures and theirs properties in near environment" in an inter and transdisciplinary approach – mathematics and ICT.

Keywords: dedicated sofware, educational resources, computer modelling, transdisciplinary approach.

1 Introduction

Due to the rapid progress of communication skills, art and technology, appear new teaching practices.

In this context, education means are diversify, occur specialized software that can be used in teaching / learning/assesment of the mathematics or natural sciences subject. This contribution is about learning the usual notions of geometrical figures (square, rectangle, triunghjul circle), the recognition of their environment, their application in practice through Scratch software. Content is content in math schedule for third class in Romanian curriculum.

2 Background

2.2 Theoretical background

Theoretical background consist of the some geometric shapes.

Quadrilaterals family. Square have 4 equal side and 4 right angle; it have also 4 lines by symmetry and are belong to the rectangular family and quadrilaterals family too. Rectangle have 4 side, 2 equal side face to face, (two by two), 2 lines by symetry and are belong to the rectangular family and quadrilaterals family too. The square and rectangle are also parallelograms. The parallelograms are the quadrilaterals what have 2 pairs of parallel sides.

Triangle have 3 side, can by acute, obtuse, right triangle (have one right angle). The triangle are isoscles (2 side are equal lenght) and equilateral (all side are equal lenght) scalene triangle (the sides have no equal sides).

Circle have no sides, have a multitudes of symetry axes.

2.2 Computational background

Used software is Scratch. Main areas of the project's Editor are five sections: the Stage, Sprite list, Backpack, Blocks palette and Script area (fig 1). In the ”Blocks palette” is controls for scripts, costumes and sounds.

Through blocks palette, the students choose the blocks of commands and drag and drop it into Script area. To the click of mouse in the script area is running the commands.

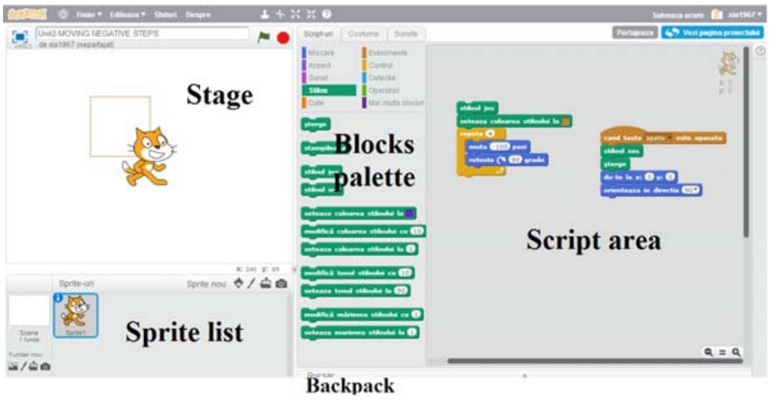

Figure 1. **Shape of Scrach. Drawing the square**

2.3 Educational resources used by students

The context of the learning activities is given by recognition of the properties of the geometric figures in their immediate environment.

Resources used by stdents are the coloured papers, computers, Scratch software; teacher use digitalboard, Schrach software, Learning Designer software.

3 Didactical methods

Teaching methods used are: explanation, conversation, experiment, discovery and computer modelling.

Lesson Plan is elaborated with help of the ”Learning Designer” software (LD) (fig. 2). Teacher can export design realised in LD software. (3.1 section)

3.1 Learning Design for: Recognition of the geometric figures and theirs properties in near environment

Context

Topic: Mathematics with Scratch
Total learning time: 100 minute
Number of students: 25

Aims

- Location of objects in near environment and the representation in familiar situations;
- Exploration of the characteristics of simple geometrical figures in familiar contexts

Outcomes: Knowledge, Comprehension, Application, Design (Synthesis):

Teaching-Learning activities

Recognition of the geometric figures and theirs properties in near environment

Read Watch Listen *10 minutes* *25 students* *Tutor is available*

Recognition of the geometric figures and theirs properties in near environment

Collaborate *10 minutes* *25 students* *Tutor is available*

Recognition of the geometric figures and theirs properties in near environment

Discuss	*15 minutes*	*25 students*	*Tutor is available*

Recognition of the geometric figures and theirs properties in near environment

Practice	*15 minutes*	*25 students*	*Tutor is available*

Mathematics with Scratch

Produce	*45 minutes*	*25 students*	*Tutor is available*

Mathematics with Scratch

Discuss	*5 minutes*	*25 students*	*Tutor is available*

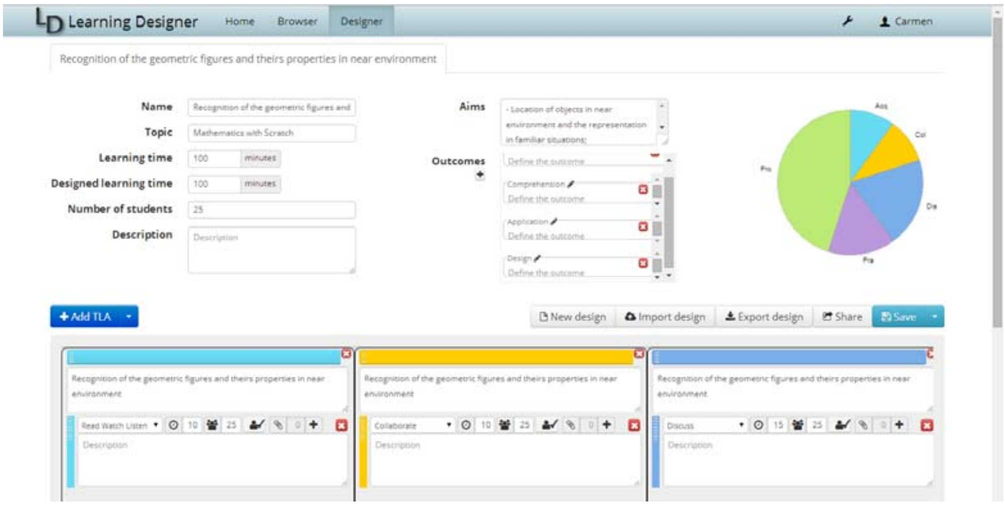

Figure 2. **Didactical resources used by theacher – Learning Designer software**

3 Learning Design

Contents: Geometric Shapes

General skills: recognition of the Geometric Shapes, and their properties in immediate environment.

Specific skills:

CS 3.1 - Location of objects in near environment and the representation in familiar situations;

CS 3.2 - Exploration of the characteristics of simple geometrical figures in familiar contexts.

3.1. Work assignments - first hour

Tasks Working for groups of 4 students.

In the next 5 minutes, find you as many objects in the class whose representation to be square, rectangle, triangle, circle.

Each student will write in their notebook: geometric shape .... and objects associated ....

The team that will find more associations in the shortest time will receive as reward colored stickers.

Students receive envelopes with geometrical shapes (fig. 2)

Figure 2. **Didactical resources used by students**

Frontal work tasks which consist discussions and questions related to geometrical figures received by students. The tasks are designed to develop specific competences explicitly mentioned.

- What geometric shapes do you have in envelope? (CS 3.1)
- Do you found the geometric figures that like with elements in our classroom? (CS 3.1, CS 3.2)
- Do you found geometric shapes in our life situations ? (CS 3.1)

The following table is presented on interactive whiteboard. It will be completed after the student answered to the questions:

- What geometric figures in the table are formed from broken lines? (CS 3.2)
- What geometric shapes are formed of curves ? (CS 3.2)

3.2. Work assignments - second hour

Tasks Working for groups of 2 students.

In the second hour, the students will apply the knowledge learned and will achieve through the Scratch software the geometrical shapes learned and theirs symmetry axes.

Teacher will present to whiteboard how can draw Quadrilaterals family: the square (fig 1) and the rectangle. Students will draw the square and his axes, like their teacher. Under the guidance of the teacher, students will be challenged to draw four squares symmetrical, thus obtaining a large square. The lines that bordering the small squares are the symmetry axes for big square. In the same way students will draw the rectangle and the his axes of symmetry.

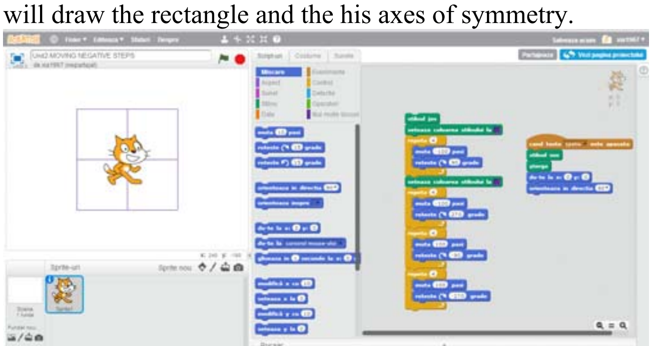

Fig. 3. **Students draw the axes of symetry of the square**

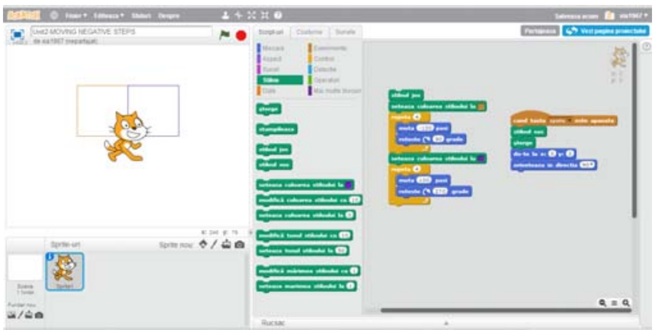

Fig 4. **Students draw the rectangle**

The teacher will teach his students how they can draw a triangle (fig 5) and a circle (fig 6) with Scrach software.

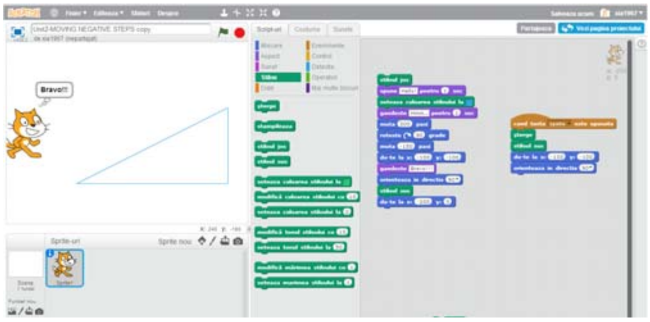

Fig 5. **Students draw the triangle**

Fig 6. **Students draw the circle and the diametre which is the symetry ax too**

4 Conclusions

Learning activity is designed to develop the practical skills but also critical thinking and the ability to anticipate of the students. The practical skills are develops by exercising some skills (cutting, gluing, coloring etc). Critical thinking and anticipation are developed through permanent search of solutions to achieve the desired product. For example, students looking for materials, trying and changing them.

The activity contributes not only the development of mathematical skills and those of science and technology, but also of the social skills, communication skills, digital literacy, artistic skills.

Possible connections with other disciplines: Visual arts and practical skills.

Extensions: Exhibitions with student products - collages with geometrical figures (eg. In the Open Doors Day activities).

Scrach software is simple, created especially for this age of students. Children can learn programming elements through blocks of commands, which combine like in a puzzle.

The purpose of this activity is to stimulate students' creativity, in other words to put math in a new light: math is or becomes art without losing his valences, can became a way to know the world or a way to structure / develop the thinking.

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Integrated project for ICT discipline

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Abstract

Project based learning is one of the effective methods that can be used at ICT (Information and Communications Technology) discipline, method also mentioned in EU documents (EACEA P9 Eurydice, 2011, p. 96). This paper presents an integrated project for ICT discipline conducted in high school. The project presented in this paper has developed pupils' skills in several areas: cognitive, attitudinal, self-regulated learning, critical thinking. Students' opinions on the project were collected through online surveys and interpreted. The observation and assessment sheets made by teacher and students' opinions have shown that project sparked students' interest, they were involved in its implementation, and they have achieved it well and very well. The scores obtained for all groups exceeded 80 points. If their cognitive and attitudinal acquisitions have proved to be good and very good, in terms of reflection and critical thinking students still face difficulties. Given the view expressed by 90% of students as it would repeat that experience of this type of projects, we conclude that integrated projects are an effective training alternative for ICT discipline.

Keywords: ICT, integrated project, high- school students.

1 Introduction

According to the Recommendation of the European Parliament and the Council, eight key competences have been defined at the EU level, which represent a combination of knowledge, skills and attitudes that are considered necessary for personal fulfilment and development; active citizenship; social inclusion; and employment (European Commission/EACEA/Eurydice, 2012, p. 7, apud. Recommendation 2006/962/EC of the European Parliament and the Council). Digital competence is one of them. The Handbook on *Digital Strategies for Educational Transformation* recommends embedding the use of ICT and digital media across the whole curriculum through specific tasks in all subjects in order to develop digital fluency (EACEA P9 Eurydice, 2011, p.40 apud. European Commission/ICT Cluster 2010, p. 29).

In Romania ICT was introduced as a separate subject at secondary level, but ICT is also a general tool for other subjects and for specific tasks in other subjects. This subject ”had to ensure acquiring knowledge of computer and ICT programs at the necessary general knowledge of relevant applicative activities in the environment in which graduates will operate”(MEC, ICT syllabus, 2009). Some of the directions outlined in the presentation note of the ICT syllabus refers to ”educate students in a spirit of group activities, in collaboration oriented on projects by assuming individual roles for carrying out work tasks”. Development of usable products and creative spirit are ”targets imposed by the economic system in which we live and we will live in the future” (ibid.).

Project based learning is one of the effective methods that can be used at ICT (Information and Communications Technology) discipline, method also mentioned in EU documents (EACEA P9 Eurydice, 2011, p. 96). “Project-based learning activities engage pupils in open-ended, long term (1 week or more) questions or problems, usually one with no known answer or no previously learned solution” (ibidem.). On the other hand transdisciplinary nature of ICT allows an integrated approach to this discipline. As defined by Humphreys, Post and Ellis (1981, p. 11) “an integrated study is one in which children broadly explore knowledge in various subjects related to certain aspects of the environment".

This paper presents an integrated project at ICT discipline conducted in high school. The project has developed pupils' skills in several areas: cognitive due to the specific tasks that they had to fulfill, attitudinal because of the need to work collaboratively, self-regulated learning by going through three phases: planning, execution / control and self-reflection (Zimermann, 2000) and critical thinking through analysis and evaluation of products made by colleagues. Students' opinions on the project were collected through online surveys and interpreted.

2 Activity description

The activity was conducted at Victor Babeş High School of Cluj-Napoca on a 6 weeks period in the school year 2013-2014, at two eleven grades Natural Sciences' specialization classes having two hours a week.

In setting goals we started from following comments. Information technology, through its specific, develop the individually work. On the other hand, through computer networks exchange of information among computer users is more effectively than any other conventional method. Whatever the contents of the application is, the product realized by students must be usable; in other words, must have all the qualities of a product.

During the development of this project were targeted following objectives:

- Educating students in the spirit of group activities through projects;
- Empowering students in completing their own work;
- Educating students for making usable products;
- Solving everyday situations through the use of ICT elements;
- Develop creative spirit;
- Critically analyze of their own activities and colleagues.

The aim was to design a project for ICT discipline that integrates all known learning units: Word, Excel, Power-Point through an interdisciplinary approach of everyday topics. This approach was possibly because the students have studied Economics and Entrepreneurship Education subjects in tenth grade. Four problems have been proposed: Football Championship, Clinic, Wages, Five Star Hotel according to Mariana Miloşescu, *Information and Communications Technology* School Book for XI-XII grades, 2006. Documents were stored on a Wiki platform project http://victorbabescluj.wikispaces.com/Proiect+Clasa+a+XI-a

The activities were organized as follows:

- It have been formed groups of 4-5 students in alphabetical order;
- Each group received one of the four problems by random choice;
- For each group was assigned a project page on Wiki platform;
- Groups have worked generally during school hours, but were groups who have worked additional at home;
- A student has coordinated and divided duties inside the group;
- Each student had achieved individual part of the project: an Excel spreadsheet, a Word document, a Power-Point presentation or a publication, poster, logo etc.;
- Each student uploaded the work on platform in order to have access at those files all group components.

The tasks for students were:

- Develop an Excel spreadsheet with all data problem in order to use Excel Program features: filtering, sorting, data validation, using Pivot Tables to extract specific information; making diagrams to represent data;
- Develop Word and Publisher documents for team logo, brochures, prices for Hotel and Clinic, lists and invitations for the Football Championship and flyers for Wages;

- Make a Power-Point presentation of the project including: a description of the solved problem, team members and individual tasks of each member, how the tasks were solved (applications used, features, formulas, diagrams, templates, etc.), the Project design, their own contribution and creative elements of team.

The project was developed during 6 weeks, for each week being allocated a step as follows:

Step 1. Establishing groups, problems distribution and workload communication by the teacher.

Step 2. Organizing groups, documenting and collecting information. Word and Publisher documents were designed.

Step 3. Project organization. It has been made out lists for each issue:

- For Football Championship: lists of round and return games etc.
- For Clinic: lists of doctors, patients, consultations rates etc.
- For Wages: list of employees' monthly salaries, seniority, degrees, etc.
- For Hotel: list of rooms, rates, room types, etc.

and have been organized information into templates (brochures, letters).

Step 4. Establishing project visual identity. Have been organized information for statistics, calculations were made using formulas / functions, tables, graphs, images, etc.

Step 5. Completing projects. Have been done all necessary documents on each project: lists, Excel tables, documents, publications, Power-point presentations etc.

Step 6 (Final) Presentation and projects assessment. Each group presented the project to peers and teacher and assessed other groups' projects.

During the project, teacher intervened with some suggestions in tasks only when requested. His role was to encourage students to learn themselves, to collaborate and formulate correct answers to questions. For a more accurate monitoring of the activities, teacher completed for each student observation sheets with following features: communication, cooperation, thinking, commitment, timeliness, rules compliance, solving problems. Thus ongoing assessment has been done by teacher and the final assessment both by teacher and students. It was used the same evaluation grid (Annex 1) so as by teacher and students. Each group was evaluated by the other three groups of students. The final grade was calculated as the average of the four assessments. Each group had between 7-10 minutes for presentation. Teacher coordinated discussions between groups of students at the end of presentations. Finally, students were asked to complete a Reflection Journal posted on the Wiki project page.

The following conclusions were outlined after carrying out the activities:

- The project gave students the opportunity to interact, help each other, to improve their knowledge in a particular field.
- Students were interested in the project and worked with pleasure, they were involved, but not equally.
- Have occurred more difficulties with the implementation of requirements due to lack of familiarization with specialized terms (e.g. for wages) or lack of interest in a specific subject (e.g.girls' lack of interest in Football).
- Gaps we have identified were: improper typing (lack of diacritics); formulas have not been sufficiently developed; files within groups didn't have a unified design – same font, images, styles etc.; lack of graphs and diagrams for interpretation of results.

3 Students perception on the integrated project

To stimulate self-reflection and metacognitive development of students, one week after the completion, students were asked to answer an online survey conducted with Google Forms in Google Drive https://docs.google.com/forms/d/1UYyUTxknAHLgtGTyVVDT-rF1u7FHOdXv3k-Mg3qirq0/viewform. The questionnaire was anonymous and 40 students have chosen to respond it voluntarily. The survey consisted of: multiple choice items with a 5-point numerical scale, check boxes items and paragraph text items.

At the first item students' impressions on the project were collected. In Figure 1 we centralized these results.

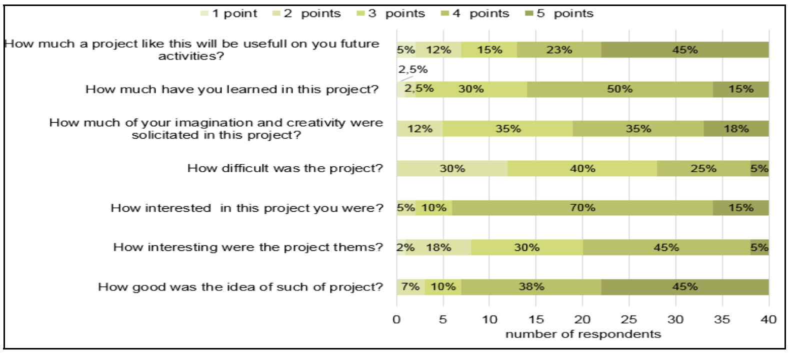

Figure 1. **Students' impressions on the project**

Students had to give scores for each statement from a list on a scale from 1 to 5 (1- not at all; 2- little; 3- average level; 4- much and 5- very much). Note that 83% of students believed that idea of such a project is a good or a very good one. Even a higher percentage, 85% of students were interested in this project much or very much, although only about a half of them felt themes interesting or very interesting. Although only 30% of students considered project difficult or very difficult, however over a half of them thought their inventiveness and creativity were requested much and very much. 65% of them have learned much or very much during project realization and even more, 68% believe that such a project is useful or very helpful for the future.

The second item aims to put students to reflect on their group activities. Students' impressions are centralized in Figure 2.

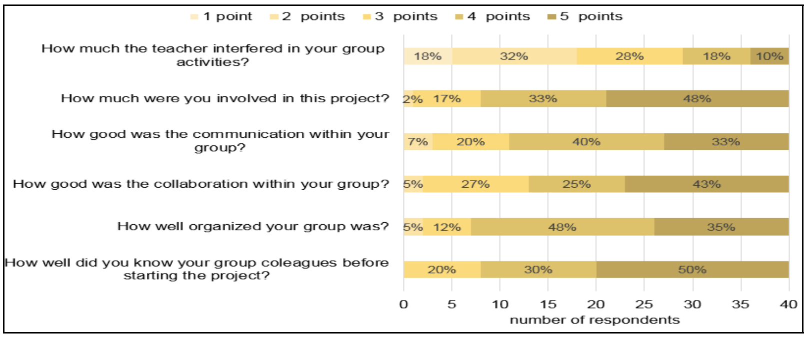

Figure 2. **Students' impressions about their group activities**

Before starting the project students generally knew their colleagues so that only 2 or 3 students found collaboration or communication between group members as rather weak. Over 80% of students believed their group organization as being good and very good. Regarding the involvement of students, 98% of them were involved at least average in projects, while over 80% were involved much or very much. These percentages are consistent with the interest of students to the project. Teacher guided group activities in a balanced manner, whereas the scores given by the students were from 1 to 5 with a mode of 3 points.

Third item analyses the assessment made by the teacher and students on a scale of 5 nonnumeric values (very correctly, correctly, quite correctly, incorrectly, do not know) revealed the fact that 98% respectively 60% of students considered that the assessment made by teacher respectively by colleagues was fair and very fair. None student consider peer assessment as incorrectly.

Regards conclusions, students had to select five statements that suit them best from a list of 21 statements. On top are the statements “Learning processes was more pleasant than other activities” (70%); “I’ve learned to take account of other opinions” (62.5%); “I understand better the importance of ICT in everyday life” (60%). Smaller percentages have next allegations “I taught to communicate better” (45%); “I learned more than through other activities” (42.5%) and “I taught to be more organized” (35%). None of students selected the allegations: “I have not been able to collaborate with team fellows” or “I had conflicts with team colleagues that we could not overcome”.

The following items asked to identify difficult elements of project, pleasant and least pleasant aspects, the most important things they have learned and of course what would it be changed in a future project. Students have succeeded in identifying only a few difficult issues of project, which is possible to be due to teamwork. However group organization, data structuring and Excel table appear to be the most difficult aspects identified by students. The most enjoyable aspect was students’ teamwork and everything follow from this: collaboration, coordination, communication with colleagues. Regarding the less pleasant aspects, they have identified only that project topics sometimes put them problems and the stress of timing in completing a task. Two issues were identified by students as the most important learned things: new Excel concepts and teamwork. Students have been asked what changing suggestions they have for a project like this one. Even if mostly students would not change anything in a project activity like this, some students would change project topics or team members. Around 15% of students have either not responded or have given the response “I do not know” or other equivalent variants. This fact show that some students have obstacles into the stage of reflection. 90% of students would repeat the experience of such projects, while 10% (4 students) were not able to comment about this.

Conclusions

The integrated project at ICT discipline allow developing students’ transversal competences. The project presented in this paper has developed pupils' skills in several areas: cognitive, attitudinal, self-regulated learning, critical thinking. The observation and assessment sheets made by teacher and students' opinions have shown that project sparked students' interest, they were involved in its implementation, and they have achieved it well and very well. The scores obtained for all groups exceeded 80 points. If their cognitive and attitudinal acquisitions have proved to be good and very good, in terms of reflection and critical thinking students still face difficulties. Given the view expressed by 90% of students as it would repeat that experience of this type of projects, we conclude that integrated projects are an effective training alternative for ICT discipline.

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The influence of using ICT on the quality of learning

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Abstract

The teaching-learning-assessment process can acquire new quality values by increasing the efficiency and effectiveness if carried out in an environment stimulating, motivating, stress relieved, based on authentic communication between teachers and students. Ensuring the quality of education is an approach that is based on multiple coordinates, some of which target the diagnosis of the learning environment and identification of means, procedures and effective training methods. In turn, teaching strategies must meet certain quality standards: have scientific consistency, be integrative, be student-centered and be centered on values. In this context, the undertaken study aimed to analyze the influence that ICT usage in the educational approach has on the quality of the educational process through comparative analysis of quality with low use of ICT and respectively increased use of new technologies. Specifically, one of targeted objectives was to analyze the influence that ICT has on students 'attitude toward learning, more specifically on attitudes towards the teacher, attitude toward school and schooling on students' motivation for learning.

Keywords: ICT, Learning, Teaching, Learning quality

1 The context of research

During the last decades new technologies have been in constant evolution, occupying an increasingly important place in everyday life. ICT tools are ubiquitous in children's lives and are part of each classroom; they supplement traditional teaching methods and teacher's direct interactions with students. The increased importance of new technologies in society spreads in the teaching process as follows (Karsenti, 2003; Boéchat-Heer, 2011).

A) At the level of teaching:
- new ways of teaching and learning are developed by introducing new school practices;
- access is provided to teaching resources and unlimited information, which may be the basis for preparing lessons or their implementation in the classroom, whether material endowment permits;
- Allows the creation of effective, qualitative learning supports;
- cooperation is promoted between schools and different school partners;
- a differentiated quality teaching is allowed, be it students with special needs, or very good;
- for certain subjects, new technologies allow simulation of complex experiments, expensive or dangerous as well as facts impossible to surprise in the real world.

B) At the level of learning:
- training and development of a critical spirit, students are able to search, select and use information personally;
- ensure a certain degree of independence in learning through access to multiple sources of information, leaving the student the freedom to explore, to choose, to compare and evaluate information;

- the strategies used by the teacher become more valuable, contributing to an improvement in pupils' attitudes to learning;
- pupils manifest increased motivation and focus on teaching scenarios which involve computerized means;
- creativity and reflexivity are developed through the achievements of the many possibilities of digital projects;
- allow development of cooperation in the classroom and outside the space between pupils and between pupils and teacher;
- individualized learning is facilitated, allowing own pace learning;
- the development of transversal skills is enabled.

The teaching-learning-assessment process can acquire new quality values by increasing the efficiency and effectiveness if carried out in an environment stimulating, motivating, stress relieved, based on authentic communication between teachers and students (Boéchat-Heer, 2011; Carugati, F. and Tomasetto, 2002). Ensuring the quality of education is an approach that is based on multiple coordinates, some of which target the diagnosis of the learning environment and identification of means, procedures and effective training methods. In turn, teaching strategies must meet certain quality standards: have scientific consistency, be integrative, be student-centered and be centered on values (Cleary, Akkari and Corti 2008). One of the teaching strategies that proves its effectiveness lately is integrating new technologies into the educational process, with positive results in the student involvement in learning, more specifically, to the attitude towards the teacher and school, towards schooling.

2. Objectives and research hypotheses

In The aim of our research is to reveal the impact that ICT use in teaching has on the quality of the educational process through comparative analysis of quality in case of low use of ICT and namely the increased use of these teaching aids (Ştefănescu, 2015).

The aim of the research is to analyze the influence that ICT has on students' attitude toward learning more specifically on attitudes towards the teacher and school, towards schooling.

The hypothesis of this study is: using ICT in teaching approach is supposed to affect students' attitude towards learning. From here they were drawn following specific assumptions:

H1. Use of ICT in educational approach causes a positive attitude towards teachers.

H2. Use of ICT in educational approach causes a positive attitude towards school (Ştefănescu, 2015).

3 Variables and research tools

The experimental approach was organized given two *independent variables*:

- use of ICT in teaching approach, with two levels of intensity: low and high;
- level of education: secondary school and highschool.

To achieve the research objectives we considered as *dependent variable* the attitude towards learning, operationalized through:

- attitude towards the teacher;
- attitude towards school and schooling (Ştefănescu, 2015).

3.1 The instruments used in the research were:

3.1.1 Rating Scale of attitude towards teachers

To assess attitudes towards teachers a specific assessment tool was developed with 7 items on the principle of Likert attitude scales with 5 levels from 1 - strongly disagree, to 5 - totally agree. The instrument accuracy was assessed by a pretesting and calculating the internal consistency coefficient alpha-Cronbach value obtained (0.81) confirming that the instrument is adequate and can be used in this study (Ștefănescu, 2015).

3.1.2 Rating Scale of attitude towards school

To assess attitudes towards school a specific assessment tool was developed with 7 items on the principle of Likert attitude scales with 5 levels from 1 - strongly disagree, to 5 - totally agree. The instrument accuracy was assessed by a pretesting and calculating the internal consistency coefficient alpha-Cronbach value obtained (0.74) confirming that the instrument is adequate and can be used in this study (Ștefănescu, 2015).

4. The sample of subjects

In order to verify the general hypothesis and research specific assumptions two groups of subjects were investigated, each consisting of 114 middle school students (58 students who used less frequently ICT tools and 56 students with more frequently use of ICT) and 112 high school students (57 students who used less frequently ICT tools and 55 students with more frequently use of ICT) (Ștefănescu, 2015).

5. Results presentation and analysis.

5.1. Students' attitude towards teachers

5.1.1. The influence of ICT usage on students' attitude to teachers

Statistic analysis of the data was performed using **the t test of significance of the difference between average (independent samples t test)** and provided the following results: t (226) =-4.908; corresponds to p <0.001; significant for a confidence results interval of 99%. Statistically, there are significant differences between the mean scores obtained by the two groups of subjects. It was found that the highest score in the evaluation scale of attitude towards teachers was obtained where the use of ICT in the classes is higher (Ștefănescu, 2015).

In terms of psycho-pedagogical, these statistical results confirm the positive impact of ICT use in respect of positive attitude towards teachers, thus confirming the specific hypothesis nr 1 (Ștefănescu, 2015).

5.1.2. Comparative analysis according to the level of education

Statistic analysis of the data was performed using the t test of significance of the difference between average (independent samples t test) and provided the following results:

- middle school students: t (114) =-3,704; corresponds to p <0.001; significant for a confidence results interval of 99%;
- high school students: t (112) =-3,214; corresponding to a p = 0.002; significant for a confidence results interval of 99%.

In terms of statistics, the significant differences between the mean scores obtained by the two groups of subjects on the assessment scale of attitude towards teachers are present both for secondary school students and for high school students, the scores being significantly higher for students participating more frequently in lessons where ICT tools are used (Ștefănescu, 2015).

In terms of psycho-pedagogical, these statistical results confirm the positive impact of ICT use regarding an improvement of attitude towards teachers both in secondary and high school (Ștefănescu, 2015).

5.2. Students' attitude toward school and schooling

5.2.1. The influence of ICT usage on students' attitude towards school

Statistic analysis of the data was performed using the t test of significance of the difference between average (independent samples t test) and provided the following results: t (226) =-3,209;

corresponding to a p = 0.002; significant for a confidence results interval of 99%. Statistically, there are significant differences between the mean scores obtained by the two groups of subjects. It was found that the highest score in the evaluation scale of attitude towards school was obtained where the use of ICT in the classes is higher (Ştefănescu, 2015).

In terms of psycho-pedagogical, these statistical results confirm the positive impact of ICT use in respect of positive attitude towards school, thus confirming the specific hypothesis nr 2 (Ştefănescu, 2015).

5.2.2. Comparative analysis according to the level of education

- middle school students: t (114) =-2,619; corresponds to p=0,010; significant for a confidence results interval of 95%;
- high school students: t (112) =-1,948; corresponding to a p = 0,054; statistically insignificant.

In terms of statistics, significant differences between the mean scores obtained by the two groups of subjects on the assessment scale of attitude towards school are present only to secondary school students, the scores were significantly higher for students who participate more often in lessons where ICT tools are used (Ştefănescu, 2015).

In terms of psycho-pedagogical, these statistical results confirm the positive impact of ICT use regarding an improvement of attitude to school only to secondary school students (Ştefănescu, 2015).

6. Conclusions

One conclusion that can be drawn from the investigation is that the use of new technologies within classes has proven positive effects in terms of students' attitude towards teachers. It is perceived by young people as an attribute of modernity, an anchor in daily life, computers open communication links between students and teachers, becoming a common language that unites generations. The student sees the teacher as a genuine partner throughout his school years, the teacher, in turn, aiming at approaching the student and facilitating knowledge through new ways specific to younger generation.

On the other hand, the perception that students have towards school and schooling may be influenced by the use of ICT in teaching, the positive attitude is more obvious in the case of middle school students. High school students' perception of school is influenced by other variables that are reflected in the act of learning in schools. Teaching strategies that integrate new technologies must meet certain quality standards, have scientific consistency, be student-centered, be centered on values. Thus, ICT becomes a part of a set of strategies subordinated to a main goal, the quality of learning.

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Enhancing corporate sustainability by e-learning: a solution for practitioners in engineering

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Abstract

In the current economic and social context is a great need to act towards sustainable development in all its aspects such as alternative energy sources, environment protection, health improvement and minimize of climate changes. To meet the critical challenges of the society the role of an product manager should also include managing and implementing sustainable principles while meeting the market requirements which following the new trends in economy ask for extended skills and qualifications. A research of the job descriptions for product managers positions in engineering opened on the market has been conducted by the authors in order to assess the requirements the employers are looking for, conceiving a list of the most wanted competencies for this decision making role. Going forward the research evaluated to which extent these requirements integrated sustainable principles. The paper suggests that the need of immediate awareness of sustainable development among the practitioners and experienced engineers or managers in engineering can be fulfilled by e-learning as a modern solution for lifelong learning. E-learning brings innovation and effectiveness in acquiring new skills and knowledge.

Keywords: Sustainable development, Product manager, e-learning, Lifelong learning

1 Introduction

Since 1987 when the Brundtland Report "*Our common future*" was published, the sustainable development became gradually a higher concern for the society. The sustainability refers not only to the environment protection but also to a different perception of the economic and social environment. This report stated that for a modern economic growth the "technology and social organization can be both managed and improved" (Our Common Future, 1987). The improvement of the society in all its aspects comes by educating all the involved agents – the governments, the society, the industry and the research.

The higher education plays a vital role to attain sustainable development (Anand et al, 2015), but the actions to achieve its goals are also oriented towards training and public awareness (Jain et al, 2013). UNESCO has initiated the UN Decade of Education for Sustainable Development (2005-2014) with the scope to promote and integrate the sustainability principles into learning and teaching and to encourage the change of attitude and perception towards a sustainable society (UNESCO, 2014).

As observed from the literature, there is a concern on how to develop the education to make it more inclined toward sustainability. The universities around the world started programs (bachelor, master, research) to educate the students for a sustainable world. Universities are adapting or renewing their curriculum according to the sustainability principles, but are also changing their education environment (campus, classrooms) into a sustainable one (Jain et al, 2013). In order to prepare the society for the future the change must be fundamental and the education systems need a transformation and rethinking in all its structures: teaching, learning, curricula and methods.

The current need is not just to educate the young people but also to train and make aware of the sustainability principles the adults, the experienced practitioners which are already on the labour market and which are often seen as "change agents", by making decisions and influencing the companies development (Hesselbarth et al, 2015).

Another direction in the current research is the change of companies towards corporate sustainability which implies a sustainable strategic management of the company (Engert, et al, 2015). The corporate sustainability has been mainly promoted by larger companies and the principal driver is the internal leadership (Lozano, 2015). Companies are providing internal trainings for their employees aimed to develop certain skills related to job requirements as well as organizational culture. The need of lifelong learning is recognized among the companies, as the knowledge acquired at school years ago is outdated and people need new competences to overcome the permanently changing work challenges.

This paper assessed which are the employer requirements as present on the labour market regarding the job of product manager and how the principles and values of sustainability are integrated. The aim of the study was to develop a simple model which can support companies to build up a training curricula for the employees, prioritizing the learning topics considering the integration of sustainable principles.

2 Research

Many of the research studies focused on enhancing sustainability from higher education perspective and approach (Rafidah Wan Alwia, 2012; Mintz and Tal, 2014; Seay, 2015), but the authors considered that it is useful to also assess the perception of the economic sector regarding the sustainability implementation and demands. Essentially the outcomes of sustainable education are knowledge and skills which future employers or entrepreneurs use to practically implement sustainable principles in the business strategy. The challenge is to obtain sustainable results in the society.

2.1 Methodology

The research conducted by the authors analyses the requirements of the employers in the engineering field for existing positions of product manager on the job market in July 2015. A direct way to obtain data was to search for and to analyse the job descriptions of these open positions. A product manager could be a change agent for sustainability within the company if he support and promote the change toward sustainable development (Hesselbarth et al, 2015).

The research comprises an analysis of 36 open jobs on the market offered by engineering companies from Europe and United States. Firstly the search was focused on the jobs from the best companies according to 2014 Fortune's 100 Best Companies to Work for. The search was then extended on the open positions in US and Europe.

The responsibilities, the minimum technical requirements, the qualifications needed, the preferred skills and abilities were summarised depending on the 3 main categories: education, technical skills and soft skills. In order to conceive a relevant and generally applicable list of the requirements for a product manager job, all the technical requirements from a specific engineering field were excluded as well as the requirements related to work experience and education in a specific field. With support from a training coordinator working for a multinational company the requirements were afterwards translated in 17 training modules which are shown in the following table:

Table 1. **Training modules based on employer requirements**

Marketing	Communication
Product development	Presentation
Project management	Customer centricity
Planning and prioritizing	Ethics & Integrity
Problem-solving	Negotiation & Persuasion Techniques
Innovation management	Teamwork
Leadership	Cultural diversity
MS Office Tools	Learning how to learn
Strategic Management	

Further, the second part of the research focused on the analysis of these training modules in terms of generic sustainability competences (based on the German ideas of Gestaltungskompetenz), which are listed in Table 2 (Wals, 2014).

Table 2. **Generic Sustainability Competences**

Competence to think in a forward-looking manner, to deal with uncertainty, and with predictions, expectations and plans for the future.
Competence to work in an interdisciplinary manner.
Competence to see interconnections, interdependencies and relationships.
Competence to achieve open-minded perception, trans-cultural understanding and cooperation.
Participatory competence.
Planning and implementation competence.
Ability to feel empathy, sympathy and solidarity.
Competence to motivate oneself and others.
Competence to reflect in a distanced manner on individual and cultural concepts.

Firstly, the above mentioned sustainability competences were ranked by their importance in fostering the sustainability within a company, by applying a Analytical Hierarchy Process (AHP) after a discussion session with 4 specialists from fields of civil engineering, energy, higher education and innovation research. This was introduced in a Quality Function Deployment (QFD) adapted to the scope of the present research: to evaluate which training module can better build up sustainable competences.

The QFD application was also a result of the same focus group and is illustrated in the above figure. So, the outcome of the first QFD was a classification of the identified necessary trainings depending on their importance for sustainability promotion.

Further, the most important categories were put under discussion, and from the competences required by the companies, it was conceived a list with the topics a training should deal with. And then these were correlated again with the sustainable competences by means of a second QFD, so that the results shows on which areas of improvement a company should focus more when building their training curricula and training program for their employees.

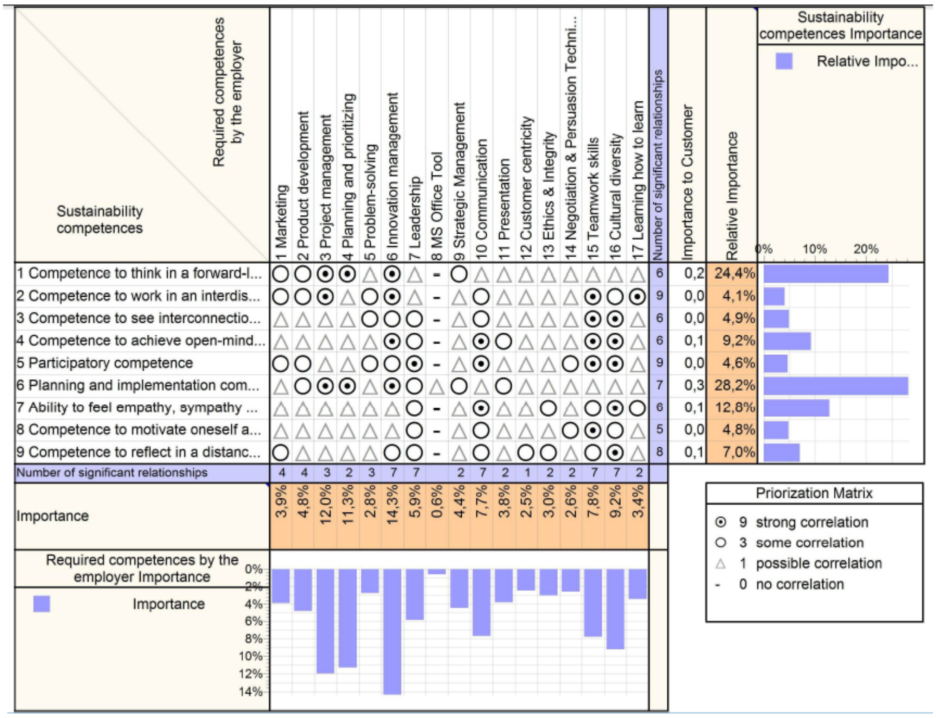

Figure 1. **QFD: Sustainability Competences vs. Training Modules**

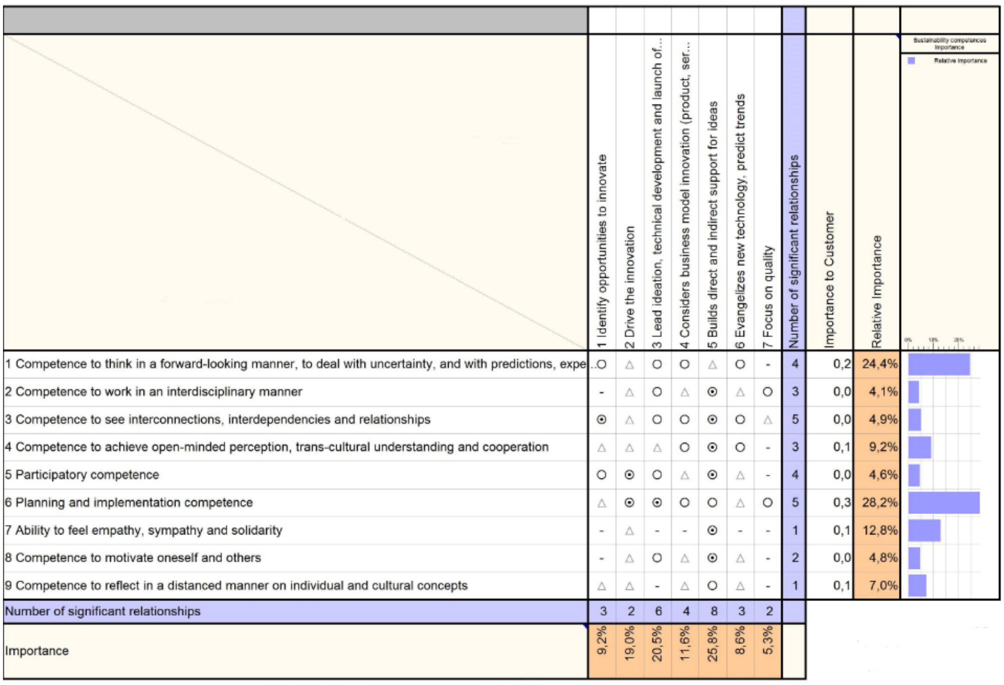

Figure 2. **QFD: Sustainability Competences vs. Training Topics for Innovation Management**

As the Innovation Management resulted to be the most significant module for enhanncing sustainability the second QFD application will use the required innovation related skills according to the job descriptions.

2.2 Results

The application of this model for the product manager showed that to increase the sustainability awareness and implementation for a product manager or potential product manager one can firstly attend courses of innovation management. The outcome (the knowledge) is maximised in this case answering both requirements from the company side and from the sustainability point of view.

The extended results shows on which areas of improvement should a company focus more when building their training curricula. The required skills have been afterwards translated in specific topics for the Innovation Management module training, where the most important topics for sustainability will have a higher share in the course organization. The Innovation Management course for example should offer more training hours to acquire the following skills: to build direct and indirect support for ideas and to lead the ideation, technical development and launch of innovtive products.

3 Discussions

A first conclusion which can be drawn after analysing the job requirements is that the requirements for a product manager job are far beyond the engineering knowledge and they comprise more interdisciplinary competences, such as marketing skills, project management skills, planning skills or leadership skills. From the first phase of the research came out that a very important requirement of the employers is the excellent use of communication skills both oral and written, but also referring to presentations, negotiations and working relationships.

The large companies as well as other SMEs are already providing internal training to their employees in order to improve their skills and keep them productive for the labour market. As resulted from the present research the training for a product manager should address not only elementary knowledge in the production field, but extended technical and personal skills in various areas. Besides that, in the future sustainability will become an area of increasingly interest for companies, being part of their strategies.

What this paper proposed is a simple tool to support companies in the phase of designing and preparing a curricula for their employees training. This model was applied in the case of a product manager, but it can be extended to all levels within a company.

Findings of the presented research suggest that as a response to the current society needs, the companies could adapt their training plans and courses curricula so that they focus more on the sustainability promotion besides their regular requirements. The authors recommended the use of e-learning methods for companies training to improve and develop new skills in accordance to the fast paced work environment and society needs, due to the challenges of time and availability of the full-time employees. As stated in the literature, e-learning systems are cost-effective and time-effective (Chen, 2010), therefore is more likely to facilitate a rapid acquire of knowledge than the traditional methods.

On the other side, by e-learning through information technology, could not acquire knowledge and skills independently; but it offers access to material customized to meet their needs without the barriers of time and space (Navimipour and Zareie, 2015).

Due to its flexibility the e-learning concept facilitates the learning of adults during the entire worklife, but the training should be initiated and intensive promoted by the companies. So, the task of the company is to prepare an appropriate training curricula meeting all social needs and to plan the right courses schedule according to the most urgent needs of the company.

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“Hands-on” Electronic Simulators for Electric Drive Systems

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Abstract

In the last years, there is a greater interest in using computers in education, and in particular, in engineering education. Software programs have a great impact on studying many physical phenomena that otherwise could be described only using very complex mathematical algorithms. Furthermore, by computer simulation it can be studied the behavior of many engineering systems before its launching in production. However, the focus many times exclusively could be a handicap for the future engineers from a different perspective: lack of real measurement and future data manipulation and interpretation. At the same time, experimental stands could be often very expensive for many university laboratories. In this article, the author presents a methodology that could be a compromise between the use of software dedicated programs and of really electrical systems. The use of electronic simulators releases the university laboratory of expensive acquisitions and does not put a very large gap between practice and theoretical concepts. Based on the block system diagram of a real system, it is constructed the electronic simulator using basic Operational Amplifier structures' circuits. The result is an electronic system simulator.

Keywords: Computer simulation, Electronic simulator, System simulation, Control System Theory, Electric motor

1 Introduction

In recent years, there is a greater current in developing the virtual education as much as possible due to many advantages: easy development, distribution and upgrade [Martin-Villalba et al., 2012]. Another advantage is the possibility of allowing people to be involved in lifelong learning educational programs [Severino et al., 2011]. The virtual simulators are used in several teaching programs of different specialties: engineering, physical sciences, social sciences, etc. [Temiz and Akuner, 2009][Kong et al., 2009][Barrios et al., 2013].

Despite the adopting current of educators around the world, “virtual only” simulators have an important impediment: they make a gap between the laboratory experiments while studying and the reality of working place after graduation. This is especially true to engineering graduates.

The present article introduces an intermediate method of teaching Electric Drive Systems and Control Systems Theory. In this article, is presented an electronic simulator for a dc electric motor. The same principle applied for the dc motor can be applied to any other physical system whose function can be expressed by linear time-invariant differential equations.

The article is structured in six chapters and covers the principle of the electronic simulator development starting with the mathematical equations and ending with the actual real implementation.

2 The transfer function and block schematic of electrical systems

In engineering applications, there are many situations in which the functions of certain systems are expressed by differential equations. Most of the times, in these applications, the numerical representation of the resulted function has to be analyzed and processed by other software or hardware systems.

In order to obtain the numerical solution of the response of a system to certain entrance signals, is a common practice to use graphic means of solving the equations. One practice applied both in the Control Systems as well as in Electrical Drive Systems is the use of Simulink/MATLAB or free equivalent software programs like Scilab.

The expression [1] illustrates a differential equation with null initial conditions. Most of the times in engineering differential equations are 'time variable' and describe the evolution of a certain system or installation in a period of time.

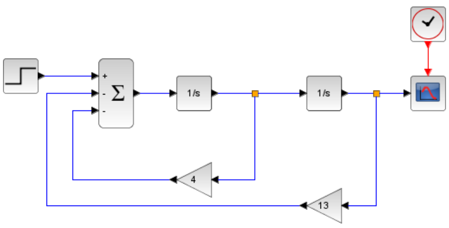
[1] $$\frac{d^2x(t)}{dx^2}+4\cdot\frac{dx(t)}{dx}+13\cdot x(t)=65\,,x(0)=0\,;\,\frac{dx(0)}{dx}=0$$

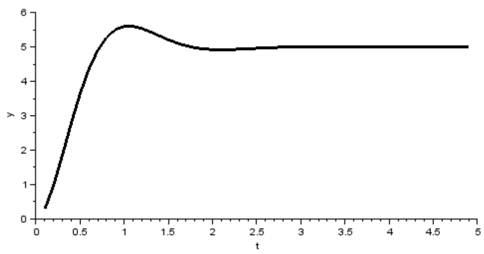
The equation [1] can be re-written in the format of expression [2].

[2] $$\ddot{x}(t)+4\cdot\dot{x}(t)+13\cdot x(t)=65\,,\; x(0)=0\,;\; \dot{x}(0)=0$$

Solving the equation [1] by applying the analytical methods, results the mathematical expression of equation [3].

[3] $$x(t)=5-5e^{-2t}\cos(3t)-\frac{10}{3}e^{-2t}\sin(3t),\; t\geq 0$$





a. Block representation
b. of equation [1]
c. Evolution in time of the solution of equation [1]

Figure 2. **Graphical representation of equation [1]**

In Electrical Engineering, there are situations in which the mathematical expression of the response signal does not present a high interest or is difficult to be obtained. In order to handle these situations was developed the Control System Theory. One of the most important aspects of this theory is to make a change from the real variable 't' to a complex variable 's' through the direct and inverse Laplace transform theory and algorithms.

The application of Control System procedures and algorithms to the equation [1] leads to the transfer function expressed by equation [4]. The solutions' evolution in time of equation [4] can be obtained from the graphical representation displayed in Figure 2.a. Figure 2.b contains the evolution in time of the solution of equation [1].

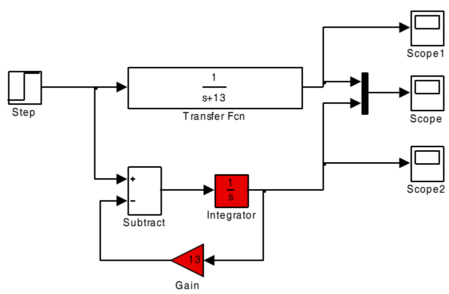
[4] $$X(s)=\frac{65}{s(s^2+4s+13)}$$

The use of the concept of 'transfer function' makes it easier the analysis of complex technical systems.

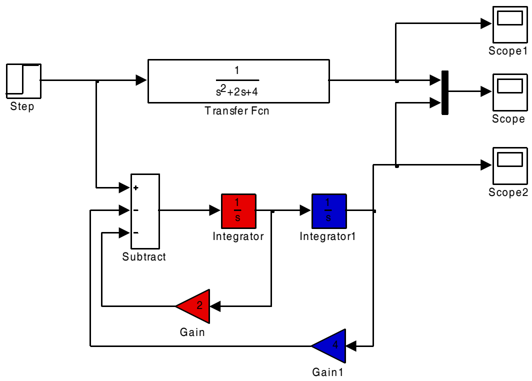
3 Electronic representation of transfer function and block schematic

A step further taken in the direction of electronic simulation is the implementation of bloc schematic such as displayed in Figure 2 using dedicated integrated circuits and networks of passive elements such as resistors and capacitors.

In the Control Theory, there are two types of standard systems that are studied and analyzed: first and second degree order systems. The degree order of such systems is according to the order of the numerator of the transfer function.



a. First degree order system



b. Second degree system

Figure 3. **Standard systems in the Control System Theory**

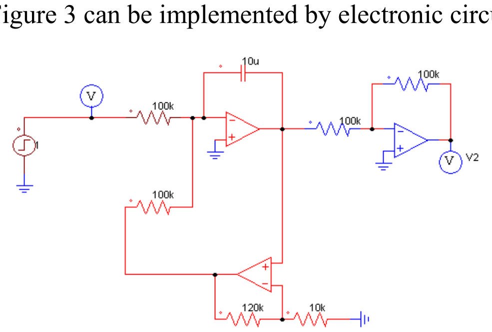
A first degree order systems' equation is indicated in equation [5] while a second degree order systems' equation is indicated in equation [6].

[5] $$G(s) = \frac{1}{s+13}$$

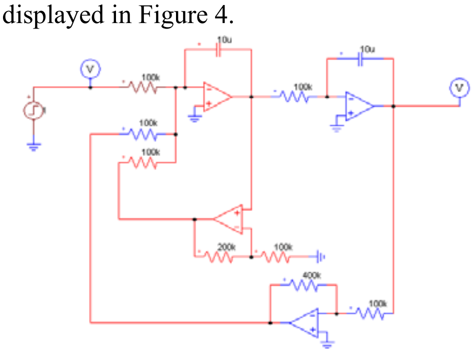
[6] $$G(s) = \frac{1}{s^2+2s+4}$$

Figure 3 displays the block diagrams of the 1st and 2nd degree order systems considered in equations [5]and [6]. The diagrams indicate the compact transfer function obtained from the equations and an expanded form of block implementation. Both representations have the same simulation results [Beloiu, 2015a].

By using OA and passive resistances and capacitors networks, the block schematics from Figure 3 can be implemented by electronic circuits displayed in Figure 4.



a. First degree order system



b. Second degree system

Figure 4. **Electronic implementation of block diagrams for 1st and 2nd degree systems displayed in Figure 3**

4 Mathematical model of dc motor with field coil

In Electrical Engineering, one of the basic systems that are studied is the direct current [dc] electric motor. This is due to its easy to understand equations and means to control. The essential electric structure of the motor consists in two coils installed on rotor and stator. The basic schematic of the dc motor is displayed in Figure 5.

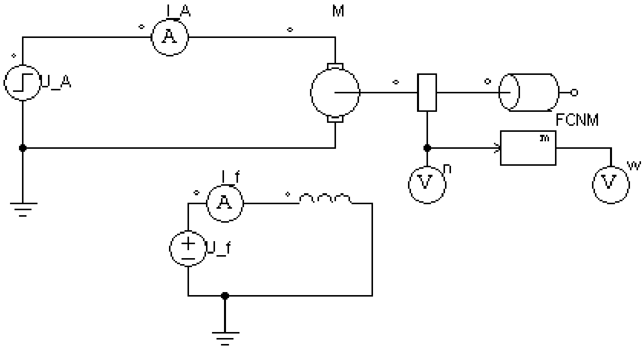


Figure 5. **DC motor schematic**

$$[7] \qquad \begin{aligned} U_A &= R_A i_A(t) + L_A \frac{di_A(t)}{dt} + K\Phi\Omega(t) \\ J\frac{d\Omega(t)}{dt} &= m - m_f - m_s \\ U_f &= R_f i_f(t) + L_f \frac{di_f(t)}{dt}; \ \Phi = f(i_f) \end{aligned}$$

By applying the Kirchhoff theorems to the electrical circuits, results the equations' system that describes the dynamic behavior of the dc motor [Fransua et al., 1978] in equation [7].

Where:

- U_A – voltage applied to motor's armature coil terminals; U_f – voltage applied to motor's field coil terminals;
- i_A – armature current; if – field current;
- R_A, L_A, R_f, L_f – electric parameters of the motor armature and filed coils: resistance and inductance;
- J – total inertial torque; f – viscous friction coefficient;
- m – electromagnetic torque; $m_f = f{\cdot}\Omega$ – viscous friction torque; m_s – kinetic friction torque.

The Laplace transform applied to [7] under null initial conditions leads to the motors' transfer function expressed by equations [8]:

$$[8] \qquad \begin{aligned} U_A &= R_A I_A(s) + L_A s I_A(s) + K\Phi\Omega(s) \\ Js\Omega(s) &= K\Phi I_A(s) - f\Omega(s) - m_s \\ U_f &= R_f I_f(s) + L_f s I_f(s) \end{aligned}$$

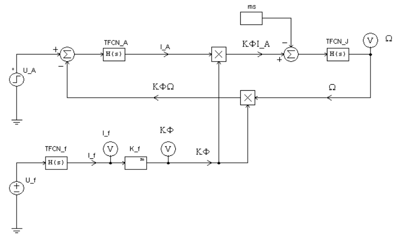


Figure 6. **Block diagram for a dc motor with separate excitation field**

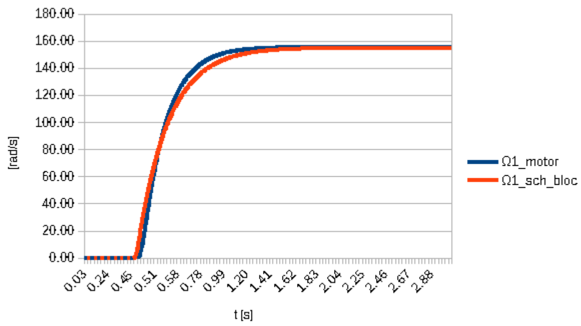


Figure 7. **Dynamic behavior of dc motor**

The dependency of the excitation flux and the field current $\Phi = f(i_f)$ can be determined through experimental measurements at nominal function conditions. This dependency is assumed to be constant regardless of the functional regime of the motor. The dynamic equation of the dc motor **Error! Reference source not found.** is converted into a block diagram displayed in Figure 6. The blocks TFCN_A/f are the implementation of the transfer function for armature and field electric circuits. The block TFCN_J implements the transfer function of the mechanical equation of the dc motor.

Figure 7 displays the dynamic behavior of the dc motor. **Ω**1 represents the speed for the motor acquired from the experimental data and software simulation [Figure 2], and **Ω**2 represents the output of the block diagram that simulates the dc motor [Figure 6]. Analyzing the two graphics it can be concluded that the block model of the motor is close approximation of the real motor tested in laboratory conditions.

5 Electronic simulator of the dc motor

The main theme of this article is the electronic implementation of the block schematic of a complex system, in particular, a dc motor displayed in Figure 6. The basic transfer functions used to model the dc motor, can be implemented by an OA combined with passive elements. The transfer function implemented by different electronic structures is indicated in Control Systems Theory manuals and books [Beloiu, 2015b][Ogata, 2010][Nise, 2011].

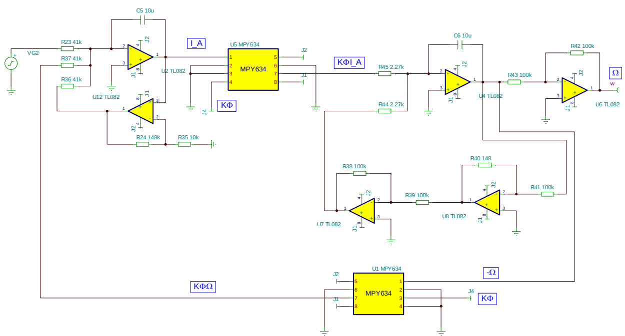


Figure 8. **Electronic implementation of the dc motor model**

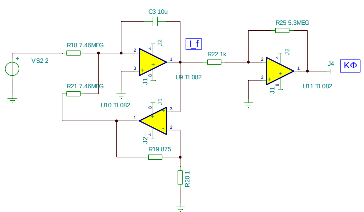


Figure 9. **Excitation field electronic circuit implementation**

In Figure 8, the circuits U2 and U12 implement the transfer function of the armature electric circuit $TFCN\_A = 1/(R_A + L_A s)$. The circuits U4, U8 and U7 implement the equivalent of the transfer function of the mechanical equations of the dc motor model $TFCN\_J = 1/(Js + f)$. Due to the change sign of the input signal of several OA structures, the output signal processed by the electronic simulator has to be multiplied by -1 so that it has the same sign as the input signal. This mathematical operation is implemented by U6 networked with R42 and R43.

The field circuit is simulated by the circuit displayed in Figure 9. The transfer function of the actual electric circuit $TFCN\_f = 1/(R_f + L_f s)$ is implemented by the circuits U9 and U10 and its' passive components networks. The output signal of this circuit represents the field excitation current I_e. In order to obtain the required parameter $K\Phi$, the I_e signal is multiplied by the K_f factor previously experimentally determined through direct measurements of the actual motor.

In Figure 6 appears two particular terms: $K\Phi I_A$ and $K\Phi\Omega$. These terms are obtained by multiplying the signals I_A/Ω with $K\Phi$. This operation of electronic multiplication of two signals is implemented in Figure 8 by the circuits U5 and U1. The transfer function of MPY634 circuit is indicated by its producer [TI, 2015].

The $K\Phi$ is applied by the jumper J4, which for U5 is connected to the x_4 input pin, while for U1 is connected to the x_3 input pin.

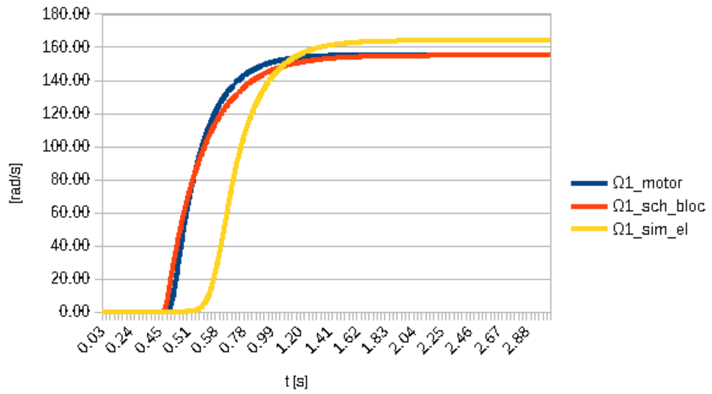


Figure 10. **Correlated output signals for: Ω1_motor –real motor output data; Ω1_sch_bloc – block schematic output data Ω1_sim_el – electronic simulator output data**

The mechanical parameters that are not indicated by the producer are determined experimentally in the laboratory, and its values are indicated in Table 2[Beloiu, 2014].

For the verification of the correct and accurate function of the presented electronic simulator, the output signal of the motor and the simulator have to be compared using the same unit scale. As they are totally different size and measurement systems, it has to be applied a correction scale indicator. The simulated output data with the electronic simulator has a minor delay in the rising domain and a slight difference in the steady domain of speed variation.

6 Conclusions

In this article was presented a solution for an electronic simulator for a dc electric motor. The presented method can be applied to any other physical system whose function can be described by linear and time-invariant differential equations.

The main advantage of this type of simulators over the "software only" simulator is that for a certain category of specialists is very important to be able to have access to "hands-on" laboratory experiments. By having access to electronic simulators, the students can still have the possibility of using measuring devices. Another important advantage is that complex systems can be simulated by electronic circuits. This method allows designers and engineers to have access to certain signals from the studied system for future processing.

The result presented in this article allows users, especially educators and students, to replace expensive stands for electric motors with more economically accessible electronic simulators without losing all the contact with the actual real systems. This method allows also the acquisition of different signals from the circuit. Thus it provides the users with the possibility of later processing.

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Developing ICT skills for communication studies students, in a technology dense environment. A Romanian experience

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Abstract

The paper focuses on the capacity of a studies program for students in communication to articulately and coherently contribute to developing the ICT skills for their future profession, through syllabuses which do not have (necessarily) technology as core topics. Digitally competent students are demanding and currently use mobile devices in their educational and extra-curricular activities and expect a high level of virtual interaction and equal competence on the part of their professors. The paper is a result of a pilot study, comparing how ICT skills are reflected in the syllabuses for the Communication and Public Relations Program, based on the monitoring of the changes, interactions among professors and professionals in acknowledging and making use of technology across disciplines, rendering visible the digital component which is compulsory for Romanian programs, in compliance with the National Qualifications Framework. The research presented in this paper aims to identify ways in which non-technical subject matters can make transparent the digital component in education both to students, and to external evaluators. The current use of computers and digital devices has been established by polling the students in a given Romanian university. The transparency of syllabuses (or lack of it) regarding the ICT skills which they aim to develop is established by document analysis and discussions with peers.

Keywords: Digital skills, Competence, Qualification Framework, Curriculum design

1 Introduction

Developing modern, updated curricula, enabling students to acquire competences relevant for the labour market is an ongoing concern of modern higher education. This concern is amplified by the processes which pose great challenges to the modern higher education system: massification, commodification, competition, globalization, accreditation, ranking, quality assessment, digitization etc. (Kirp, 2004). Among the strong responses the European Union states to address these chalenges is the effort to create a unified European Area of Higher Education, within which a European Qualifications Framework offers a transparent and clear reading of the teaching-learning outcomes for the programs at the three levels of degrees: bachelor-masteral-doctoral studies (http://www.ehea.info/article-details.aspx?ArticleId=69). This research is based on the author's experience as an expert for developing the grid within communication sciences programs, as it is consecrated by the Romanian National Qualifications Framework (www.rncis.ro), on the work in the Board of specialization for Communication and Public Relations Programme at Politehnica University of Timisoara, on literature research and on dialogues with professionals in PR industry, in Romania.

The European education Ministers' Declaration in Leuven (2009) states that "With labour markets increasingly relying on higher education skill levels and transversal competencies, higher education should equip students with the advanced knowledge, skills and competences they need throughout their professional lives". Further, in the European documents on the matter, competencies are detailed as professional competencies and transversal competencies. The first category refers to the proven capacity to select, combine, and use knowledge, skills and other attainments (such as values and attitudes) which are specific to a professional activity in order to solve successfully problem situations related to the specific profession, effectively and efficiently. Transversal competencies are those that transcend a certain fields or study programme, such as teamwork skills, oral and written communication in mother tongue/foreign languages etc.

For programmes in communication and Public Relations, in Romania, five professional and three transversal competencies are identified in the National Qualifications Framework, universities having the possibility to develop two additional professional competencies, which can give identity and uniqueness to a study programme in this field. Among the compulsory professional competencies *Use of new technologies in information and communication* (NTIC) is listed as the second, after the *Identification and use of terminology, methods and knowledge in communication sciences*. Since the use of NTIC becomes increasingly more important in the PR profession, the aim of this research is to look in-depth into the curriculum design which aims to educate future proficient PR professionals for the industry (Waddington, 2012).

2 Method and results

Implementing the requirements of the Romanian National Qualifications Framework required, on the part of higher education institutions, an intensive effort to understand and develop adequate documents, policies, and procedures, starting with 2012 (OMECTS 5703 2011). Syllabuses describing the subject matters which guide the students throughout study years towards obtaining a degree had to be drafted in the language and formats imposed by RNCIS. In Politehnica University of Timisoara, the task to follow through the correspondence between syllabuses within a curriculum falls on the part of Boards of specialization, which include professors teaching in the study programme, student representatives and professionals from key employers in the labour market.

As chairperson of the Board for Communication and Public Relations programme, and taking into account the experience in the team of experts for communication studies grids in RNCIS, I gather, compare and offer guidance to professors which teach in the Communication and Public Relations programme. As a researcher, I am interested not only in the formal aspect of syllabuses and their conformity with the provisions of RNCIS, but also in the shaping of professional competencies of Romanian students, which later have to integrate into a competitive and growing market (Palea, 2013).

In 2015 the curriculum for the Communication and Public Relations programme in Politehnica University of Timisoara contains 45 disciplines and aims at developing 5+2 professional competencies, five compulsory and two additional, proposed to enhance the alumni's capacity to tackle the European labour market, due to the fact that special emphasis is given to communication and mediation skills in foreign languages. I will not deal with the transversal competencies, because in the topic of this research they are less relevant. Upon analysing the contents of syllabuses for the above mentioned 45 disciplines, such as they are submitted by professors, I extracted the reference to the competencies each syllabus declares to develop, from a statistical point of view. Thus:

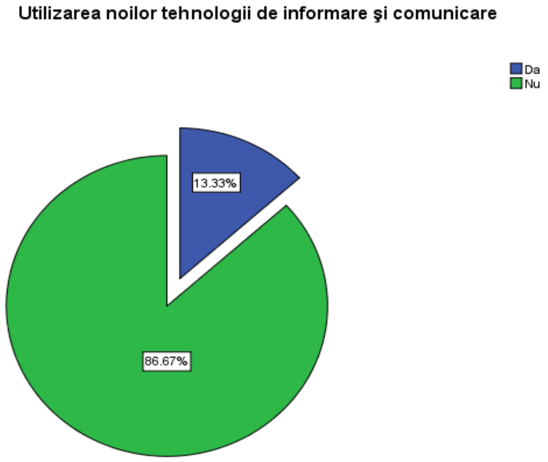

Figure 1. **Use of NTIC (in general, per discipline)**

If only 13.33% of the syllabuses aim at developing the use of new technologies in information and communication, the following question is how these disciplines are spread within the study programme, and the statistics show that the first year of study has a low interest in forming this competence (only 6.67% of the disciplines – one out of 15). Disciplines in the second study year do not aim to contribute to developing this competence at all. The burden falls on the last, graduating year, with 38.46% of the disciplines working towards this goal (5 out of 13 disciplines).

The spread is not more balanced throughout semesters, although a certain continuity and coherence would have been expected on building upon already acquired experiences. Figure 2 scrutinizes the use of NTIC as it is described (or not) in disciplines taught each of the 6 semesters at the bachelor level:

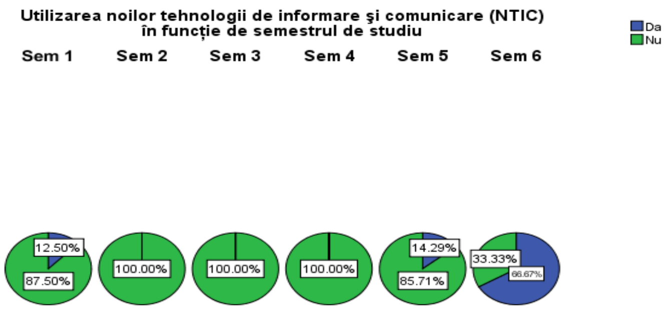

Figure 2. **Use of NTIC (in general, per semester)**

Students enrolled in this study programme declare that they use computers for their learning (83.3%), smart phones (45.8%) and tablets (27.7%) and often present their work with the help of mobile devices, giving preference to these over traditional portofolios or printed files (Cernicova, Dragomir, 2015). However, they clearly see that in the classroom environment the use of NTIC is significantly lower, professors incorporating computers and tablets in the teaching process less than 50% of the time (Cernicova, Dragomir, 2015).

In the professional context, however, the expectations for making use of communication technologies is exponentially higher. A recent overview of the penetration of social media platforms in Romania shows that the number of Facebook accounts, for instance, is over 8 million user accounts (compared to around 16 million active population). LinkedIn has over 1.7 million accounts, Trilulilu (the Romanian equivalent of Twitter) has more than 2.4 million unique visitors, Youtube is a channel with over 800 thousand user accounts and over 7 million unique visitors (http://www.tree.ro/social-media-in-romania-iulie-2015). Such numbers make it compulsory for professional communicators to take into account digital channels both for external communication, and even for internal communication in organizations. Even if the job advertisments for PR positions in Romania (at least so far) do not make the digital competences as selection requirements, it is expected that in communication campaigns specialists in communication and Public Relations integrate the mobile technologies, acknowledge the use of computers/laptops/tablets/smartphones in dealing with the media and optimize the distribution of their messages for all types of (mobile) devices (Cernicova, Palea, 2014). Therefore, programmes offered by universities aiming to educate professionals in communication and PR cannot overlook the signals coming from the market and professional practices. On one hand, the Communication from the Comission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions as soon as 2008 [SEC (2008) 3058] warned that it is important to look at *New Skills for New Jobs – Anticipating and mathcing labour market and skills needs* (http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52008DC0868& from =EN). On the other hand, the active encouragement of the Digital Agenda provisions in Europe expand the use of NTIC in all areas of life (http://ec.europa.eu/digital-agenda/en/digital-agenda-europe-2020-strategy). Communicators, therefore, have to master these technologies at a high level. In the analized case, there seems to be a lack of balance regarding the attention and emphasis put on developing the digital competence in education programmes:

Table 1: **Frequencies of competencies in the curriculum**

		Responses		
		N	Percent	Percent of Cases
$C1_7[a]	Type of discipline	8	9.8%	17.8%
	C1. Identification and use of terminology, methods and knowledge in communication sciences	17	20.7%	37.8%
	C2. Use of new technologies in information and communication (NTIC)	6	7.3%	13.3%
	C3.Identification and use of appropriate strategies, methods and communication techniques in PR processes	15	18.3%	33.3%
	C4. Creation and promotion of a PR product	14	17.1%	31.1%
	C5. Specialized assistance in crisis communication and in mediating communication conflicts	10	12.2%	22.2%

	C6. Professional and institutional communication for evaluating the efficiency of communication in foreign languages (English, French, German)	8	9.8%	17.8%
	C7. Cultural and linguistic mediation in foreign languages (English, French, German)	4	4.9%	8.9%
	Total	82	100.0%	182.2%

a. Dichotomy group tabulated at value 1

Such analyses, of the degree to which different disciplines in a study programme aim or declare to develop the competences for a given profession encourage professors to reflect upon the teaching philosophy, the strategies for implementing the study programme, the learning outcomes, and the place of the taught discipline(s) within the curriculum design.

3 Discussion and consequences

The implementation of the European Qualifications Framework – and the National Qualifications Framework, in particular – brought for academia challenges in understanding and using methodological and instrumental components to describe each level of competences developed by study programmes. The exercise of writing the syllabus according to the given, standardized pattern forces professors to reflect and revisit their understanding of the competences they aim to develop in students. Beyond the educational practice, of writing the syllabuses, professors need to discuss, across the curriculum, their strategies, interactions, methods, in order to render coherence and substance to the teaching-learning processes. The analysis of all disciplines in a study programme, along the lines of the targeted competences, gives the possibility to understand the ambitions and tasks of that programme.

Constraints on the programmes come from requirements posed by accreditation agencies, by the ministries of education, by European documents (in Romania's case), by the relevance of the labour market – among the most salient factors. Experiences in Romanian universities are very diverse. For Communication and Public Relations, in some higher education institutions the board of the programme decides upon content, supervises the reflection of competences in syllabuses and attempts to trigger the necessary changes and updates to maintain the programme attractive and relevant for the labour market. Other universities prefer a top-down approach, leaving the decisions on the curriculum design in the hand of department chairs. Mixed models are also in place. Yet the alumni of the programmes compete on the same arena, integrate (or not) similar strategies, at times are exposed to the variety of approaches while choosing a master and/or doctoral programme in institutions other than their original Alma Mater.

The digital competence – which can best express the requirement for an efficient and effective use of new technologies in information and communication – is a core one for professional communicators. The study reveals that there is a lack of balance along the programme and a discontinuity in working towards developing this particular competence. At the beginning of the programme, it is left on the shoulders of a general, introductory course in NTIC. After three 'blank" semesters, the student is invited to renew his/her interest in this competence and work towards it through already more advanced and specialized courses. But all this time students use digital devices for learning, for documentation, for work and for leisure. This experience should be exploited and transferred into professional and/or educational contexts to a larger extent. This study is a basis for discussing, modernizing and updating the syllabuses and for an improved curriculum design. In educational practice, it is a type of exercise which gives impetus to change forces. In educational research, on the other hand, it opens the discussion regarding balance, coherence, coordination across the curriculum, in finding adequate responses to the many challenges that higher education undergoes in the 21st century not only in communication sciences and in Romania, but also in Europe and all over the world. Further research will refine tools for analysis of the curriculum in the given area (communication sciences), and will compare the programme taught in the university with prototypes and models developed in Europe, aiming to enhance the digital component and competencies in communication sciences programmes.

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Romanian Primary School Teachers and ICT

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Abstract

ICT (Information and Communications Technology) has now gone a long way and has pervaded all domains, education included. We expect teachers to be well qualified to use ICT in their activities, but are they? More exactly, this paper aims to investigate Romanian primary school teachers' ICT needs as well as their practice habits in relation with ICT. Considering the 8 key competences promoted in EU documents, we are interested in finding out the rank Romanian primary school teachers set to the ICT key-competence in their teaching practice. Moreover, we try to establish how frequently Romanian primary school teachers use ICT resources in their teaching practice as compared to other available resources. The quality of a lesson plan obviously influences the successfulness of every class; thus, we focus on Romanian primary school teachers' opinion about the usefulness of the internet in lesson planning. In addition to that, given the overwhelming use of devices in everyday life, ICT could be used to enhance the pedagogical quality of any lesson – therefore we look into Romanian primary school teachers' techniques and methods to see whether they use ICT in their class practice. The conclusions of this research reinforce previous investigations: there are important material obstacles, as well as a wide gap between continuous training and practice habits, which leads to ICT underuse by Romanian primary school teachers.

Keywords: ICT, Primary Education, Primary School Teachers, ICT in teaching practice and lesson planning, primary school teachers' continuous training needs

1 Introduction

Since, for the time being, preschool education is not compulsory in Romania, primary education represents any individual's first meeting with the system that would mold his/her personality so as to become a useful member of the society. This educational stage forms the absolutely necessary basis for any subsequent development not only because it is the starting point, but also because it may function as a roadmap. On the other hand, we live in the 21st century and information technology is all around us, and, even if we want it or not, from very early ages, our children are exposed to the Internet, smartphones, mobile learning, social networks etc. According to recent research findings, there are multiple benefits to integrating ICT in teaching activities, no matter the discipline or the school level: students find lessons more attractive; students' motivation increases; the quality of the teaching process improves; the 8 key-competences are better developed (Kozma, 2011; Klimova, 2012; Popa and Bucur, 2012; Tongkaw, 2013; Bucur and Popa, 2013; Munteanu et al, 2014; Hussein, 2015; Lupu and Laurentiu, 2015; Büyükbaykal, 2015).

Taking into consideration these directions, this paper focuses on Romanian primary school teachers and their willingness, as well as their competences to integrate ICT in their teaching practice. In part one, we briefly outline the role that ICT could have in maximizing the expected results of the teaching and learning (T&L) process and we scrutinize the current Romanian curriculum for primary education in order to identify the position of ICT, viewed both as a distinct curriculum subject and as a set of skills/competences to be acquired, possibly at interdisciplinary level. This serves as a theoretical background for our research that tries to find out whether and also to what extent the ICT-related provisions of the formal curriculum for primary education are identifiable at class level. Our questionnaire based analysis helps us to conclude that primary school teachers could benefit from well-organized and meaningful continuous training that could really arouse their interest and persuade them about the short, medium and long term usefulness and positive impact of integrating ICT strategies in their teaching practice.

2 Overview of ICT in primary schools

Traditionally, primary education represented the period when children were given the opportunity to become literate and numerate in a formal environment, and, in addition to that, it was a synonym for compulsory education. Gradually, during the 20th century, educational goals and objectives became more complex due to the developments that marked every aspect of our society. At present, in all European countries primary education represents only the first step, since the duration of compulsory schooling varies between 9 and 13 years (Eurydice, 2015).

Lifelong learning is the new educational paradigm that national systems around the world have already implemented more or less successfully. Nowadays, curriculum developers' main task is to ensure that students will be equipped with the necessary competences that will enable them to cope with the continuously changing demands of the present and, possibly, of the future.

At EU level, the educational guidelines are centered on key-competences, which are considered fundamental for each individual in a knowledge-based society, as they could provide flexible pathways for lifelong skills development. Among these, the digital competence involves the confident and critical use of information society technology (IST) and thus basic skills in ICT.

As far as ICT in primary education is concerned, recent research has shown that (1) there are opportunities provided by ICT in teaching and learning that need to be exploited in order to maximize the acquisition of the other competences; (2) teachers need to assume new roles in ICT-enhanced T&L in primary schools; (3) there are limitations to the use of ICT in primary schools; (4) certain conditions need to be met in order to support ICT-enhanced T&L practices in primary schools (UNESCO, 2012). Thus, ICT may serve various roles in schools for the purpose of enhancing students' learning, for example, as information, situating, construction and/or communication tools. As for primary school teachers, they are expected to play various roles in supporting ICT-enhanced learning: they must be learners who keep on developing and enhancing their own ICT capacity, in order to guide their students; they must provide scaffolding activities for students and intervene into their learning; they must support computer-supported collaboration among students; they must facilitate human interactions in ICT-enhanced learning activities; they must provide psychological supports to students; they must become experts of study materials in class. Researchers (UNESCO, 2012) have also identified limitations for ICT application, pointing to several aspects: computer technology cannot always substitute teachers' support; students may overlook the most important information when there is a lot of other distracting information on the computer screen; cyber bullying vs cyber-wellness. Regarding the necessary conditions to support ICT for T&L in primary schools, curriculum provisions, physical and technological infrastructure, as well as professional development opportunities are worth mentioning here.

ICT in the curriculum takes three forms or models of implementation: (i) ICT integrated across curriculum, (ii) ICT as a distinct curriculum subject, and (iii) Informatics (or Computer Science, Computing etc.) as a distinct curriculum subject (UNESCO, 2012). According to a 2012 EU report, in Romanian secondary schools, ICT (1) is taught as a general tool for other subjects/or as a tool for specific tasks in other subjects; (2) is included within technology as a subject; and (3) is taught as a separate subject, *but is not included at primary school level* (European Schoolnet and University of Liège, 2012). By analyzing current Romanian curricular documents for primary education, the situation described above has not changed to a great extent. Thus, ICT as a distinct curriculum subject was first introduced in the curriculum framework for primary education in 2012 for the preparatory grade, when this grade became part of this educational stage (2011 National Education Act). Nevertheless, the status of the discipline was vague (0-1 class per week) and it was seldom included in the class schedule, mainly due to obstacles (lack of resources; lack of specialist teachers; primary school teachers' mentality or skepticism; primary school teachers' lack of specific ICT competences, see Popa and Bucur, 2012). Consequently, the next school year, when subject curricula for primary education were revised, ICT vanished from the curriculum framework. The only possibility for ICT to be part of the class schedule in Romanian primary education is to be on the list of elective subjects, and under these circumstances the subject curriculum for ICT is designed by the teacher in charge with teaching the discipline. If ICT is elected, material obstacles have to be surpassed: 'in Romania there are considerably fewer computers available for educational purposes for all grade students than the EU average' (European Schoolnet and University of Liège, 2012).

In recent documents referring to curricular policies in Romania (RIE, 2015), the development of digital competence is one of the major goals of primary education. Nevertheless, Romanian research points to the discrepancy between educational provisions and the reality of the teaching practices: 'the challenge is to go beyond words and use or learn to use relevant teaching strategies that could help students to acquire and develop the key-competences' (RIE, 2015). In our situation, the development of the students' digital competence should result from the cumulated efforts made by all teachers individually, by enhancing the value of ICT-based teaching techniques they use, no matter the discipline they teach, no matter whether ICT as a distinct curriculum subject exists, or this competence could emerge when teachers work in teams, using an interdisciplinary approach. Our research is mainly focused on this challenge, as we consider that teachers' class activity could positively contribute to students' successfully acquiring and developing digital competence in primary school.

3 Methodology

The survey was conducted online in 2014 and included a sample of 346 primary school teachers from Prahova County. The sample is 93.35% made up of females and 6.65% males, the proportion being somewhat different from national statistics (86% females vs. 14% males). 57.8% are from the urban area and 42.2% from the rural area. The age variable divided our sample into three categories: 32.1% - under 35 years old; 29.8% - between 36 and 45 years old and 38.2% - over 46 years old. 93.64 of our sample are tenured teachers (as compared to current situation in Prahova County – only 74.7% primary school teachers have tenured positions). As for their teacher certification, most our subjects are expert teachers: 60.98% are level 1 teachers, 13.87% are level 2 teachers, 16.18% have permanent teacher certification and only 8.96 are novice teachers. In point of degrees, 84.1% of the subjects are higher education graduates and only 15.9% are high-school or post-secondary education graduates. The teachers' experience in primary education divided our sample into five groups: 25.43% - more than 30 years; 21.97% – between 21 and 30 years; 23.7% – between 11 and 20 years; 9.54 – between 5 and 10 years; 19.36% - less than 5 years. These data indicate our subjects' high level of qualification and broad experience in primary education.

Our questionnaire stemmed from the following research questions: (1) Which key competences do Romanian primary school teachers most frequently aim to develop along this educational stage? (2) How frequently do Romanian primary school teachers use ICT resources in their teaching practice as compared to other available resources? (3) Do Romanian primary school teachers find the internet important when they plan their lessons? (4) How frequently do Romanian primary school teachers use ICT methods or techniques in their teaching practice? (5) Which are the domains that Romanian primary school teachers would consider for further training? Thus, we expected to be able to point to Romanian primary school teachers' degree of involvement with ICT in their current teaching practice in order to identify possible problems and eventually suggest future necessary actions. To process the data we obtained, we used SPSS 20.

4 Findings and Discussion

When asked about how frequently they focus on developing each key competence in their teaching practice, the subjects of our enquiry placed the digital competence on the last but one place, before communication in foreign languages (Table 1):

Table 1. **The frequency of key competences in primary school teachers' current practice**

Key Competence	Weighted Average
Communication in the mother tongue	4.96
Mathematical competence and basic competences in science and technology	4.78
Social and civic competences	4.55
Learning to learn	4.47
Cultural awareness and expression	4.19
Sense of initiative and entrepreneurship	3.83
Digital competence	3.65
Communication in foreign languages	3.20

The place occupied by the foreign language(s) and the digital competence could be easily explained, as these disciplines are not in a primary school teacher's teaching load and more often than not a primary school teacher is not required to have such competences. In addition to that, if we take into account the lack of material resources, the actual possibilities of studying ICT as a distinct discipline in the primary school curriculum, as well as the primary school teachers' digital skills, then the position occupied by the digital competence in a primary school teacher's development tactics does not need further argumentation, even if great importance is attached to it in everyday life. Moreover, curricular documents in force do not explicitly include reference to the digital competence as such – it is more about developing this competence indirectly, at each primary school teacher's will, by using ICT techniques and methods in order to enhance the other competences.

Taking into consideration the resources that primary school teachers most frequently use in their teaching practice, as expected, we find the traditional ones in top three: blackboard and notebooks (4.86 weighted average), individual worksheets (4.65 weighted average), manuals (4.52 weighted average). The resources that could contribute to developing students' digital competence are ranked lower (computers - 3.89 weighted average; ICT - 3.80 weighted average; video materials - 3.77 weighted average), very close to one another. Thus, even if, in theory, key-competences should receive equal attention, in reality, given the resources used by primary school teachers in their practice, they are not well balanced.

Table 2. **The importance of internet resources in lesson planning**

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Very important	107	30.9	32.5	32.5
	Important	149	43.1	45.3	77.8
	Moderately important	23	6.6	7.0	84.8
	Slightly important	42	12.1	12.8	97.6
	Not at all important	8	2.3	2.4	100.0
	Total	329	95.1	100.0	
Missing	System	17	4.9		
TOTAL		**346**	**100,0**		

As for the resources that primary school teachers deem important when doing their lesson planning, we obtained the following weighted averages: official curricular documents – 4.64; manuals – 4.21; library – 3.95; internet – 3.92; exercise books – 3.83. So, the internet gets the fourth place in their ranking even if most of our subjects (77.8%) consider it to be important and very important (see Table 2). One possible explanation for our respondents' traditional attitude towards the process of lesson planning is that they are less used to innovating their practices, preferring more to follow the *beaten track*.

In point of methods and techniques used in primary school teachers' current practice, the results of our investigation underline previous findings: ICT methods and techniques are the least used of all (the lowest score = 3.35 weighted average, out of 25 items). The obtained ranking gives a detailed description of the class reality, still heavily dominated by the magister role of the teacher and by predominantly verbal interactions, which take place between the teacher and the student. This reality is less conducive to contexts that could favour students' actions, stimulate their initiatives, look for/question solutions (as latter methods and techniques require using ICT). Even if the official curricular documents suggest Romanian primary school teachers to be flexible and encourage independent thinking, these educators are still very much trapped into the old educational paradigm – teacher as distributor of knowledge; concepts presented as facts to memorize; intelligence as a matter of linguistic and logical/mathematical abilities etc.

How could primary school teachers change their approach to their current teaching practice? We consider that ICT is the answer, and our survey subjects admitted that they need further training in this domain:

Table 3. **Primary school teachers' continuous training needs**

Frequencies / **Needs**	**Responses**		**Percent of Cases**
	N	**Percent**	
Knowledge related to various fields	68	7.2%	20.7%
Didactics of the disciplines	74	7.8%	22.6%
Child Psychology	124	13.0%	37.8%
Curriculum Theory and Methodology	127	13.4%	38.7%
Assessment Theory and Methodology	85	8.9%	25.9%
Efficient Communication	71	7.5%	21.6%
Didactic Planning	77	8.1%	23.5%
Using ICT	179	18.8%	54.6%
Educational Counselling	138	14.5%	42.1%
Others	8	0.8%	2.4%
TOTAL	**951**	**100.0%**	**289.9%**

Our respondents had the possibility to make as many choices as they wanted and the result was that they placed *Using ICT*, as their first need (see Table 3). Thus, if we correlate these findings with previous ones (digital competence is not among the most targeted competences; computers and ICT resources are not very frequently used; there are more important resources than the internet to be used in lesson planning; ICT methods and techniques are the least used), we have some coordinates pointing to the relation between primary school teachers and ICT.

5 Conclusions

According to the EC report on ICT in education in Europe (2013), a very large majority of school heads and teachers agree or strongly agree about the relevance of ICT use in different learning activities. Moreover, they agree or strongly agree that ICT use has a positive impact on students' motivation and achievement, as well as on the development of their transversal and higher order thinking skills, as well as that ICT use in T&L is essential to prepare students to live and work in the 21st century. What is more, in the case of Romania, the score concerning all these aspects is higher than the EU average. Nevertheless, the EC report point to an intriguing issue: school heads – and teachers even more so – agree or strongly agree about the need for a 'radical change' for ICT to be fully exploited in T&L.

As for our own research findings, we consider them intriguing as well: although the subjects of our enquiry acknowledge the benefits of integrating ICT in T&L, their practice habits do not show evidence of their high appreciation of ICT tools; even if they have been exposed to both initial and continuous training, they point to their need for further training, especially regarding the use of technologies. On the one hand, it is likely that campaigns aimed at school heads and teachers to convince them of the relevance and positive impact of ICT use *are no longer of value*, as a large majority of them appear to already believe this (EC, 2013). Nevertheless, this might not be the case for Romanian primary school teachers and we consider that this campaign should continue until better results start showing. Moreover, based on our subjects' answers, the opinion that continuous training cannot go beyond its perfunctory status in the Romanian education system seems to gain more ground.

ICT in Romanian primary education has to surpass various obstacles: material obstacles (Romania has been below the EU average and there are no changing signs); pedagogical obstacles (at EU level no major increase took place between 2006-2013 – our survey indicates that in Romania, the situation is stationary as well) and some obstacles that are more difficult to categorize (parents and teachers' resistance; lack of interest; unclear benefits; ICT use not being a goal in schools; school time, space organization and examination pressure), which could be very easy to explain if we consider the current political and social context in Romania. Therefore, we suggest that efforts should channel on two directions: (1) providing *meaningful* continuous training, which should focus more on the practical side so as to demonstrate the positive correlation between ICT use and student performance; additionally, post-training feedback sessions should exist, so that continuous, unconditioned support could be made available; (2) changing school-financing policies, so that additional income sources could be used to improve the existing ICT infrastructure.

Given the limits of our research (only one Romanian county – economically well-developed and highly urbanized as compared to the rest of the counties; sample covering less than 1/3 of the total population of primary school teachers in Prahova county, probably because we chose to send our questionnaire by email), we would like to suggest that national scale research is badly needed. Thus, more precise data could be obtain that might or, on the contrary, might not reinforce our findings (large gap between primary school teachers' opinions/ attitudes/ beliefs and their ICT-related teaching practice, as well as training needs) so that, in the end, optimal solutions might be envisaged and implemented at national level, pervading all school cycles.

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Using an Integrated Adaptive Forth System in Education

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Abstract

Forth is the first IDE (integrated development environment) that preceded Turbo Pascal by 15 years. Despite that, it still plays an important role, because it is a really appropriate tool for the development of micro systems. The most important characteristic of Forth, that also offers its main advantage, is its extensibility. On the other hand, we also have to mention some other features of the language, like its portability, the low-level need for resources and its rapidity. And if we take into account how suitable Forth for interactive communication is, we can easily understand why its use so adequate for a faster and more efficient software development is. By the same reason, it is conceivable that Forth would be proper to be used in education too. However, integrating technologies like Internet, databases, 3D, etc. require a considerably effort both from developers and later from users of a Forth implementation. Combining Forth with existing RAD systems offers the possibility to interface easily the needed functions with minimum effort and extension of the Forth system. Our presentation is meant to exhibit a new solution for using Forth in education by combining it with existing Pascal and C++ Systems. The examples will show how simple and straightforward this procedure is. Examples will focus on classic educational subjects like turtle graphics and recursion.

Keywords: Innovative Teaching and Learning Technologies, Forth Programming Language, Lazarus Platform

1 Introduction

Nowadays, there is practically no field of specialisation in Romanian universities, the curricula of which does not include the study of information and communication technologies (ICT) in one form or another: informatics, computer sciences, etc. In many cases this means just some basic notions of Microsoft Office software, usually Word, Excel, PowerPoint and, if there is some more time, even basic notions of Access. Of course, teaching office software packages is a very comfortable way of doing our job because it does not require too much effort from the teacher, nor the student, especially when taking into consideration that most of them still have some basic knowledge of the applications.

A basic question does manifestly arise in this situation: why do we need to teach ICT at the university? In our opinion, teaching ICT does have its justification, as far we place it in a broader context, not reducing it to the user level exposition of some office software. Our reasons are, briefly, as follows:

- assuring an everyday-purpose, base level digital literacy for each student;
- developing autonomous thinking by dismantling the authority of technology and encouraging students to verify machine-generated results in their actual context;
- disenchanting technology, by determining students to adopt a rational and critical way when approaching new means of ICT;
- increasing, on the other hand, the students' confidence in new achievements of ICT, either hard- or software;
- shifting from a quantitative to a qualitative art of thinking by encouraging students to verify and interpret the results provided by computers;

- acquiring an algorithmic way of thinking by using logical problem-analysis and a rational, step-by-step method of solving it.

2 An Example

When talking about the necessity of teaching kids programming, Douglas Rushkoff, American media scientist and author, used to say: “We teach kids how to use software to write, but not how to write software. This means they have access to the capabilities given to them by others, but not the power to determine the value-creating capabilities of these technologies for themselves.” (Rushkoff, 2010).

This quotation appears also on the opening page of the 4E4th - Forth for Education webpage, dedicated to the most popular (until now) application of the Forth programming environment in education (4E4th - Forth For Education, n.d.). The Forth for Education - 4E4th and 4E4th IDE project was initialised by Dirk Bruehl in 2012, when, as a Forth user, he finally met the hardware he needed (Bruehl, n.d.). This was the Texas Instruments MSP-EXP430FR5739 Experimenter Board, a developer platform for the MSP430FR57xx devices (Texas Instruments, dátum nélk.). This proved to be a proper basis for the microcontroller devices capable to integrate the new generation MSP430, Ferroelectric Random Access Memories, being at the same time compatible with several low-consumption wireless TI modules.

On the other hand, Forth was the first IDE (Integrated Development Environment), preceding by more than 10 years Turbo Pascal. An integrated development environment (IDE) is a software application that provides comprehensive facilities to computer programmers for software development. An IDE normally consists of a source code editor, build automation tools and a debugger. Many early Forth implementations worked without operating system, it means that they fulfilled also the functions of an OS.

The main question regarding our choice is: why precisely Forth? The most striking response to this question was given by Charles H. Moore, the builder of the language, namely: “Forth is an existence proof. It shows that a computer language can be simple and powerful. It also shows that ‘The race is not to the swift.’ The best solution is not necessarily the popular one. But popularity is not a requirement. There are many applications where a good solution is more important than popular methodology.”(Hamilton, 2008).

Until machines did communicate with the outer world just with an alphanumerical display and a keyboard almost every computer / processor had its own version of Forth and the programmes were almost completely transferable between them. But the appearance of new technologies, like USB, Internet, etc. made the incorporation of their usage into the development systems mandatory. There were several attempts to develop Forth, but usually inan ‘intensive’ manner, i.e. by mean of extending the vocabulary. E.g. the win32forth 2014 December Release contains more than 5000 Forth words.

The main point of the actual project is accessing these new possibilities from within Forth, practically without extending the basic vocabulary. By using a special text-field, which serves to accept commands and concomitantly functions as a display,the Forth system can, actually, be built into any Delphi/Lazarus programme. Because the code and data segments are common, every Lazarus component can be controlled by the Forth code. On fig. 1-7 we present some pictures about programmes made with the help of our system. Maybe the most appropriate illustration of the possibilities of this combination is that one of the attached minimal Turtle Graphics. This was built up with just 5-6 lines of code, by using the interpreter and word-building capabilities of Forth and the simple drawing functions of Lazarus. We appreciate that, without Forth, this would take several days of programming and testing and need some hundred lines of code. By using purely Forth, this would be an even longer procedure; only describing the windows and drawing canvases would need low-level definition of a lot of words with 8-10 parameters, completely deviating from the Forth philosophy.

Because the tools we used: Lazarus (Lazarus - The professional Free Pascal RAD IDE, n.d.),and Net wide Assembler(NASM, n.d.),are free and cross platform projects, the Forth-system built in this manner can run under Windows, MAC and also Linux systems. At the same time, the platform is free and no copyright is infringed. With some more work, it could be made work under C++, C# or some other platforms, but because of cross platform and open source considerations, we have concentrated on Lazarus.

Maybe the only significant difference between our system and Forth 79is the replacement of the memory management and editing functions. In the beginning, when Forth started, there were only expensive, small-capacity external memories available and, as a consequence, the original versions of Forth were projected in a very parsimonious way, by using 1024 byte long screens, sometimes even without any file structure. Nowadays, this is, obviously, no point anymore; the present project can use a simple notepad-style editor and the code or a fragment of it can be copied from any editor, so one can use an external, e.g. 'syntax highlight capable' editor. The already tested code can be saved in a random place, under a random name, according to the needs of the user. The Forth 79 standard used 16-bit elements and, obviously, the 32-bit implementation made them obsolete and the difference between them is minimal.

We want to stress that the present project constitutes not a random series of module-calls written in a different language, but an organic symbiosis of the two systems. The programme control happens in Forth by using Lazarus components, while the Lazarus-code has direct access to the Forth stack, variables and vocabulary (although the least one is not recommended). We cannot present it on a static screenshot, but in the Turtle-example the colour of the pen can be changed while running and a global speed-controller was also built into it.

In this system, the Forth part is a 32 bit Intel ASM module and it uses the registers of the processor, in contrast with other cross platform implementations where the system is built up with Java code and memory variables. This fact guarantees a running speed higher by some orders of magnitude and it is closer to the original Forth spirit too.

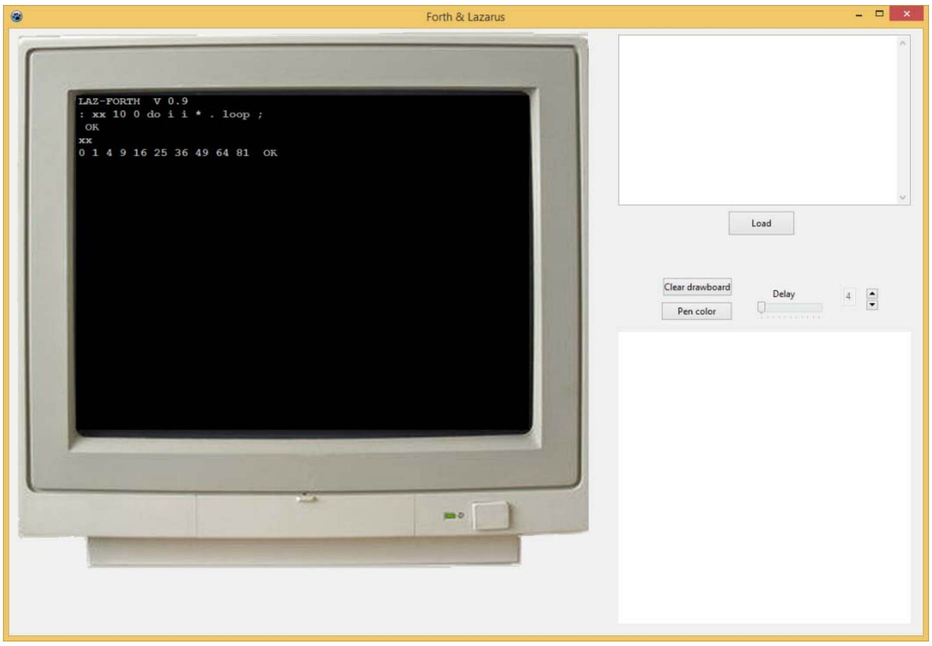

Fig. 1. **Basic functioning:simple word definition and running**

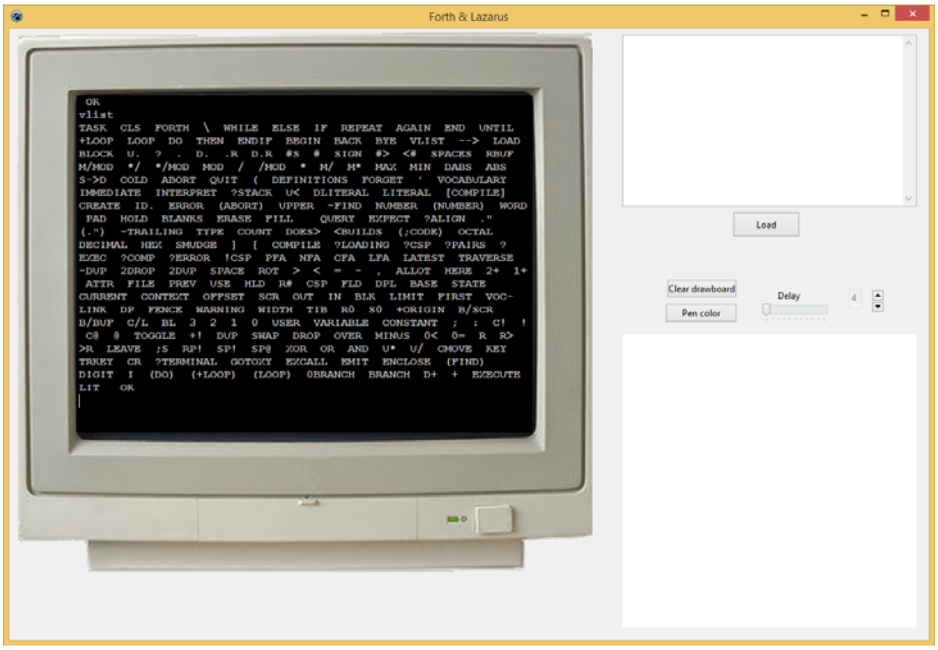

Fig. 2. **The whole Forth vocabulary (~200 words) 90+ % compatibility with Forth-79 standard**

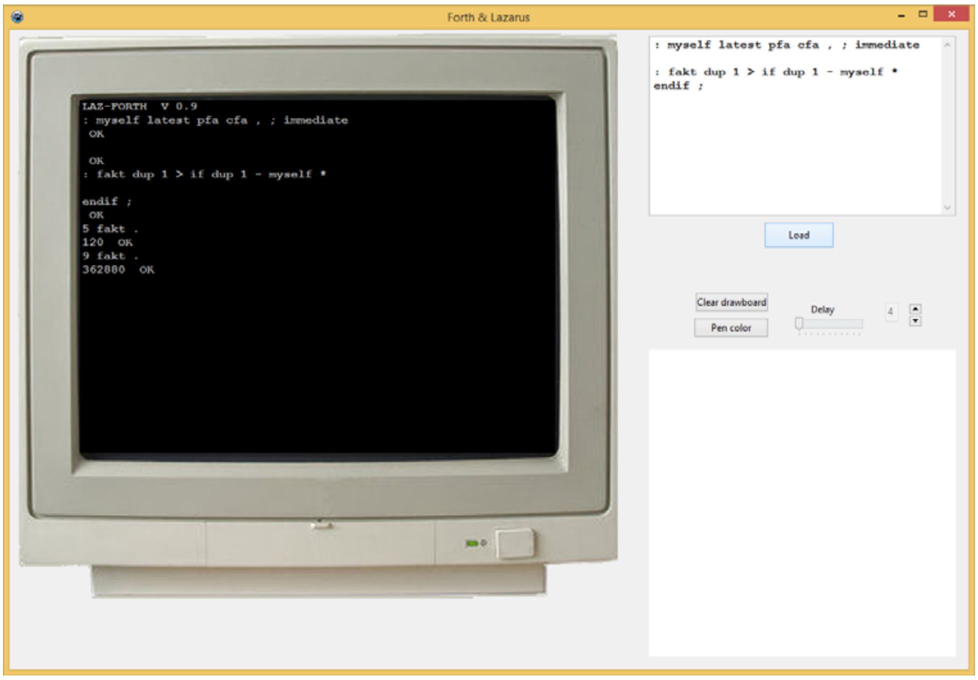

Fig. 3. **Forth recursionillustrated with factorial calculus**

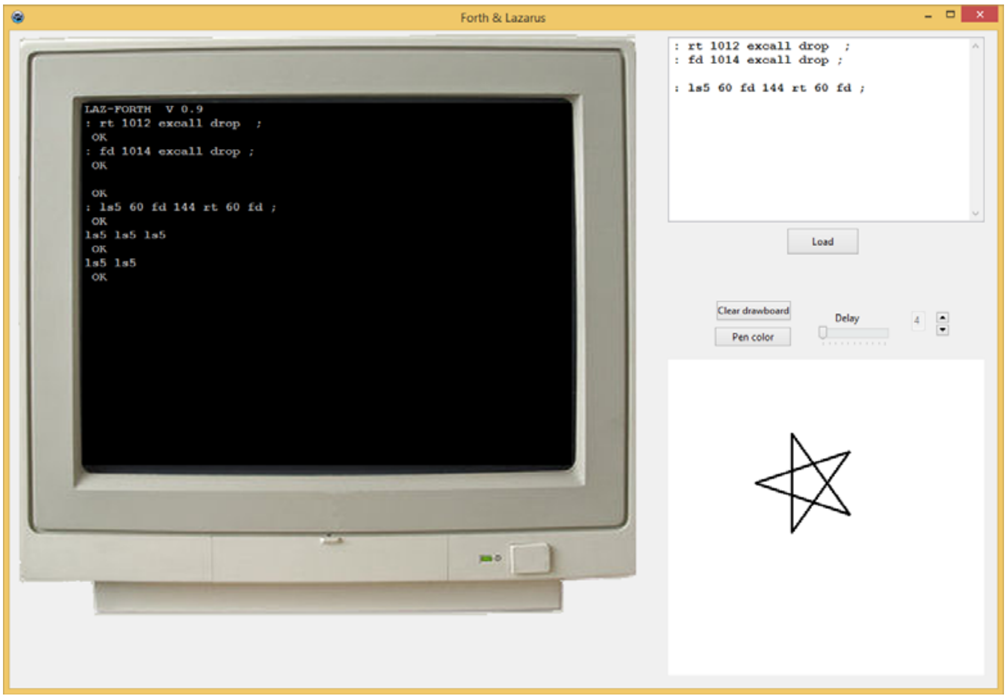

Fig. 4. **Turtle demo 1**

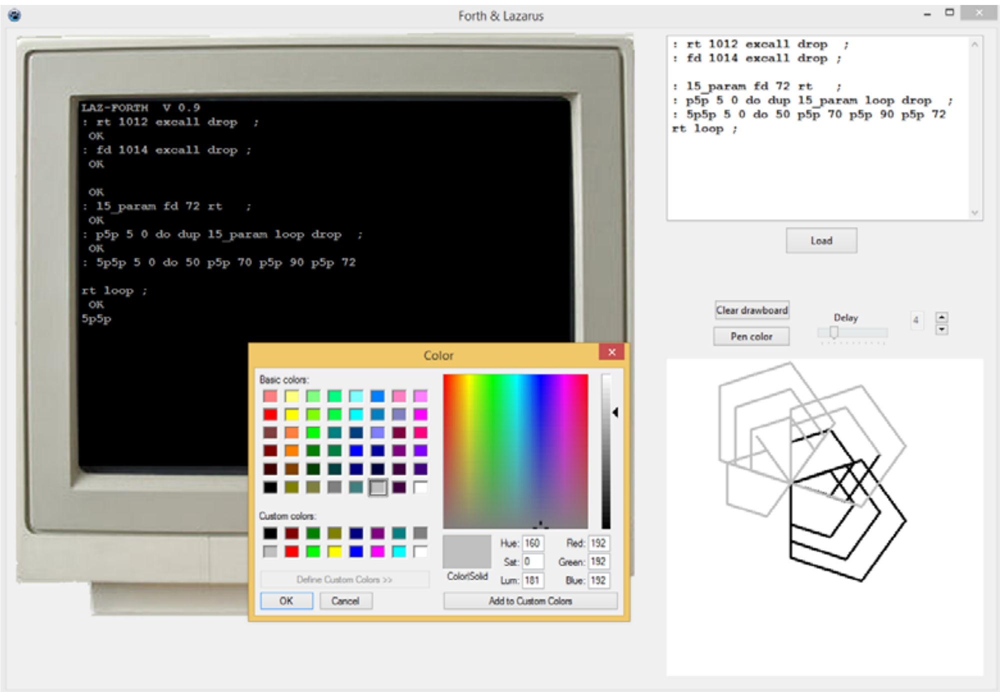

Fig. 5. **Turtle demo 2, while running, changing pen colour**

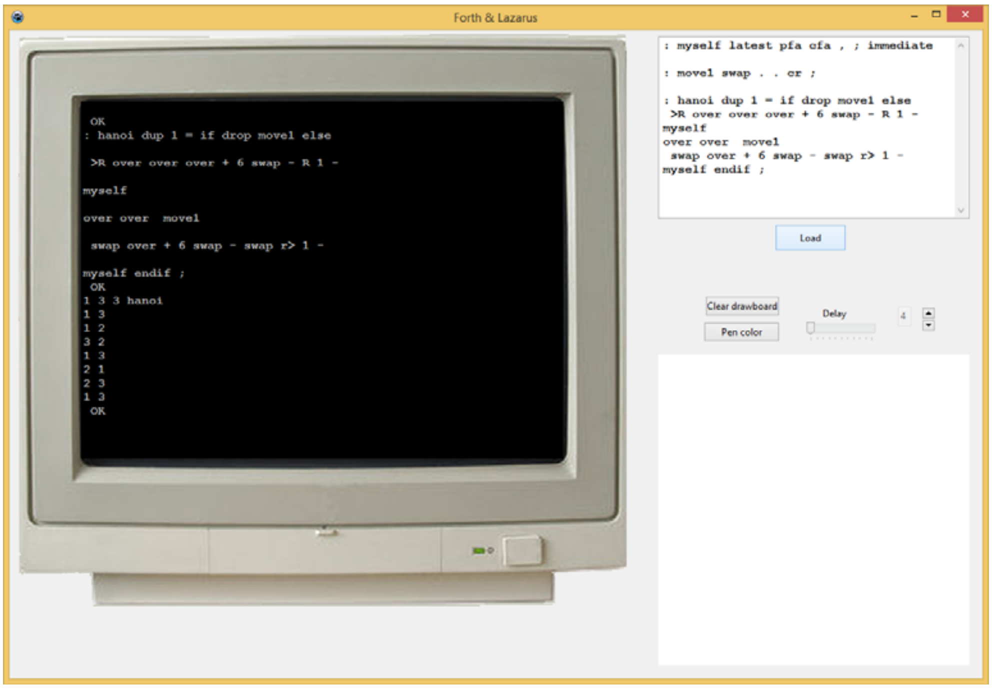

Fig. 6. **Towers of Hanoi,'pure' Forth**

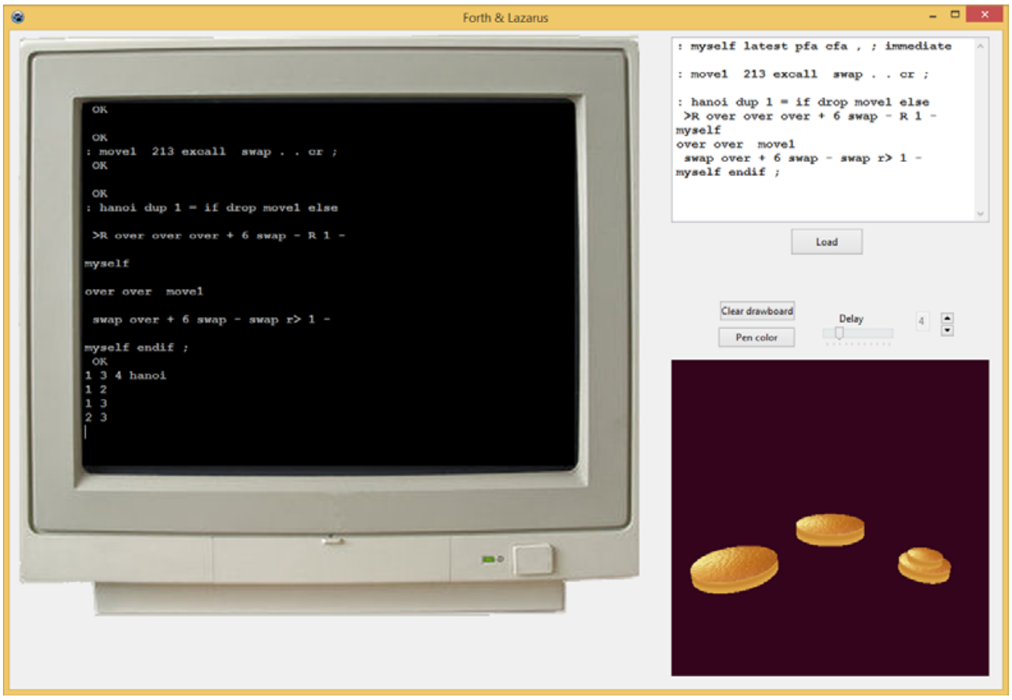

Fig. 7. **Towers of Hanoi, 3D**

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Pedagogical Implications of Using NetSupport School Application in Teaching Educational Sciences

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Abstract

The NetSupport School application offers teachers the opportunity to streamline teaching and to focus on monitoring and control the individual learners or small groups. Starting from the premise that an adjutant NetSupport School application is important for teaching, setting and checking the specific contents of Educational Sciences, we used as the method of investigation the questionnaire-based survey managed to a fixed sample, based on a priori choice of people, 20 teachers from higher education that apply into different teaching sequences the NetSupport School application in the education process. Through this study we aim to highlight the advantages of using this educational software solutions, such as: more rapid and through assimilation of knowledge by students using the program, compared to traditional teaching, developing self-control and self-regulation through self-correcting exercises conducted in the program, motivating students to work in a pleasant and attractive way and speed up the evaluation process in terms of enhanced objectivity in its various phases (predictive, formative and summative).

Keywords: NetSupport School application, educational software, digital skills, interactive classes

1 Conceptualisations

The contemporary didactic process is oriented towards the frequent utilisation of ICT (the information and communication technology) both in formal and informal contexts, as a natural consequence of the paradigm change, with implications upon knowledge, as a general rule, and upon school learning, in particular.

The utilisation of ICT and of certain educational software programmes (AeL, NetSupport School, Platforma Oracle Academy, the Moodle e-learning platform, Live@Edu, W3Schools, the IT Essentials platform etc.) within the teaching, learning and evaluation processes is part of the natural evolution of human development and suggests a modification of the pedagogical subjects architecture in accordance with the new generation of trainable people called *digital natives* by the American author Marc Prensky in 2001. Delia Dumitrescu (2013) deems it to be: *the facedown generation, digital residents, the 404 generation (not found), the ubiquitous generation or the global generation*.

The features of this generation's personality suppose a new combination of cognitive skills, derived from a different neuronal connection, influenced by the technology from the early age, which enable the focus on training simultaneously with the deployment of several activities at the same time, as they wish to be provided immediate feedbacks, as they obtain the same in their digitalised and digitised *habitat*.

Seen as a reference phenomenon in the evolution of society, *digitalisation* represents the human individual's activity of using the technology of storing, processing, searching and acknowledging information amongst on-line users, technically built on an electronic infrastructure that enables the incessant remote transmission and reception of information.

The definition of the 'digitalisation' term has been in dictionaries ever since the '70s, however the 'digitisation' term is still ambiguous, sometimes deemed to be synonymous to 'digitalisation', even though this one supposes a group of processes by which a physical format can be converted into a digital format, like in case of the handbooks, which by digitisation become digitable, more useful and easier for the digital natives.

The digital native is characterised by *the online media repertoire*, which represents certain media utilisation habits that are relatively constant in time and which are an indication of the role of Internet in structuring the trainable people's daily activities.

The media repertoire is not only a sum of the various media activities, but rather a complex, goal-oriented structure, according to such individual needs as the daily duration of Internet utilisation, the kind of the on-line activities, the specificity of the logged on contents, the motivations that bring forth the Internet utilisation, the manner of integration into the structure of the daily activities and the subjective interpretation of the Internet utilisation (Tőkés, 2014).

2 The specificity of the NetSupport School educational software

NetSupport School is a world leader in form management and in educational software solutions. The headquarters of the 25-year experienced manufacturing company is the UK. Even though it falls into the e-learning category, too, it is completely different in terms of design and AeL implementation, which is better known to the Romanian faculties. It focuses more on monitoring and controlling trainable people than on interactively training pupils. The faculties can prove, monitor and have visual and auditory interactions with the pupils and the university students in a simple efficient way and the form management provides an adequate range of characteristics, including the ability of displaying a screen in the classroom or of viewing the Tutor programme on the screens simultaneously.

Its main products are NetSupport Manager (remote control and PC management), NetSupport School (the form management) and the freshest products, NetSupport School Tutor and Student for Android, all these being available in more than 90 countries around the globe.

Such a learning management system aims at rendering the knowledge acquisition process more efficient and at developing new skills and abilities by managing the pupils' and the university students' access and progress and by coordinating the educational resources online.

The computers may be fallen into groups according to certain criteria of the faculty, including by manual selection, with the possibility of carrying out actions, of indicating applications and contents to one or to all the selected PCs.

The possibility of computer-monitoring the form, with individual or group restrictions, the control of the access to the Internet, the presentation of tasks or assessment instruments in real time customize and secure the work space. During a lecture, all the issues linked to the topic set out can be captured and automatically included in a pdf file, in order to be seen again by each student later on, after the lecture is over.

The lecture attendee's unique log provides complete recordings of the topics debated upon, an abstract for each student that will have skipped the lecture and an organised presentation of the professor's activity (http://www.netsupportsoftware.ro/biblio/NetSupport_School_10.pdf).

The NetSupport School programme has got the following main features :

- it facilitates the creation of a virtual form and of the text materials for interactive, goal-detailed classes;
- it offers the possibility of viewing the student's outcomes at various tests;
- the professor's screen can be seen as a miniature on the lecture attendees' monitors;
- the lecture attendees' screens can be viewed as miniatures on the professor's monitor, along with the possibility of completely controlling their screens, keyboards or cursors;
- it offers the possibility of automatically sending the text materials and collecting the files on and from the trainable people's stations;

- on-line chatting, live chatting, which offer the possibility of talking to the lecture attendees by means of the speakers on their computers;
- one may elaborate materials for the interactive classes and make up a library of questions for tests;
- the professor can take over the files from the lecture attendees' stations when they come up against difficulties;
- one may monitor the Messenger-type applications in real time;
- the professor can monitor the work rhythm of the entire form or the individual rhythms and he/she can view the content of the texts that circulate amongst the students.

3 Hypothesis, goals and methodology

In this study we depart from the idea that the NetSupport School application facilitates the teaching, the learning and the evaluation of the contents suggested for the pedagogical subjects specific to the educational curricula for the following BA level specialisation : the pedagogy for the pre-school and elementary education and for the pedagogical branch pupils.

Application utilisation goals :

We envisage the goals below during our study and the programme putting into practice :

- to make the pupils and the university students assimilate knowledge more quickly and more thoroughly by means of the programme, as compared to traditional teaching;
- to develop self-control by the self-correction and self-adjustment exercises developed within the programme;
- to motivate pupils and students to work in a pleasant attractive way, different from the day-to-day classes;
- to shape and to develop digital skills;
- to make assessments more objectively in various stages (predictive, formative and summative), by putting down each pupil's and student's performances according to training phases and performance levels and to store the same.

For putting these goals into practice we will have to cover a number of stages, of contents, as well as to draw up and to apply the adequate pedagogical-methodological intervention and measurement instruments.

In terms of methodology, we used the questionnaire-based inquiry method. It was an instrument used for a non probabilistic sample of 20 faculties from the pre-academic and academic education, who teach pedagogical subjects and who had been rendered familiar to the specificity of the NetSupport School educational software.

The questionnaire applied comprised a set of general items (surname, forename(s), didactic position, specialty, educational seniority and didactic degree) and items with open answers, free choice answers and multiple answers, by means of which we planned to offer the questioned persons the possibility of freely express themselves, wishing to grasp both common points and particularisations of the pedagogical implications of the application embodied in advantages and limits.

Please note that the research methodology limits the generalisation of the results obtained by us, because of the restricted sample, of the respondents' possible subjectivity and of the qualitative character of the answers obtained by us to the open items.

4 Ascertaining trial outcomes

The methodological limits being taken up, the pedagogical implications of this software are obvious at the level of the form management, seen from the viewpoint of the ICT developments and of the digital natives' generation needs.

The advantages claimed by the respondents in case of using the NetSupport School application in teaching the pedagogical subjects arise from the fact that :

- the students interact and collaborate more efficiently in digital environments;
- the professors further learning by discovery, reflection and metacognition, by using instruments meant to encourage the students to reflect upon their own learning experiences;
- the training approaches might be customised and individualised in accordance with the learning styles, by designing differentiated digital instruments;
- the formative and summative evaluation is facilitated by the possibility of coming up with individualised tests;
- this is an approach by which individual progress is monitored more easily;
- the professor can provide immediate feedbacks and can assist the lecture attendees that have a slow working rhythm;
- the application favours the more introvert students, who would not ask questions within a traditional educational process;
- questionnaire-based inquiries that could clearly identify progress or any deficiencies in the formal education can be drawn up;
- the NetSupport School application facilitates project-based learning, learning by cooperation and collaborative learning.

The questionnaire also encompassed an open item, which called for listing a possible limit for implementing this educational software. The faculties that took part in this trial identified the weaknesses below :

- The utilisation of this application supposes the attendance of professional development programmes or of workshops in the faculty's spare time.
- The application is time consuming : the one made available by the educational curriculum and from the standpoint of the additional explanations that the tutor-professor has to provide to the lecture attendees.
- The implementation of this educational software supposes costs related to the purchase of the very programme and of the licences.
- The excess utilisation of the digital skills restricts pen or pencil writing.
- This application does not offer lesson packs, as the same can be found in AEL.
- It limits the faculties' walking within the classroom enclosure.

As regards the item linked to the possible negative influence, at the relational level, of the frequent utilisation of these approaches based on didactic software solutions, 15 of the 20 respondents claim that computerised training will affect the pupil's and the student's socialisation and emotions and even the professor-student relationship will be affected by the individual covering of the learning contents. Nevertheless, at the item by which we investigated their opinion linked to the ICT delimitation from the didactic process in the near future, all the faculties questioned think that the educational process will not exist if both the faculties and the trainable people do not have digital skills.

With respect to the *'Teaching my means of the peripheral input, output, input/output devices will have a higher rate than traditional teaching.'* allegation, 58 % of the respondents agree with it and 42 % think that traditional teaching will keep on ranking first.

As a logical consequence of the theoretical approach set out above, the purpose of the practical trial, alongside its ascertaining character, is also to draw the attention on whether the utilisation of alternative strategies corresponding to the digital native pupil's and student's personality profile is needed and called for.

5 Conclusions

The educative value of this software is obvious – from the point of view of both the faculty and the trainable person, as it enables the deployment of very well coordinated didactic activities by which school progress can be monitored by assessment instruments able to provide immediate feedback.

As far as the application utilisation in teaching the subjects included in the epistemic nucleus of educational sciences is concerned, our opinion is that the challenge brought forth by the digital handbook introduction gets the future faculties familiar with the adequate utilisation of these new teaching-learning didactic approaches, ruling out the risk of uselessness.

Recent trials claim the efficiency of the NetSupport School application in the development of vocabulary, of language and in mother tongue learning, as well (Noeparast, Khatami, 2014).

The implementation of such software solutions is conditioned by the faculties' initial training by fully valorising the IT and applicative school subjects (such as computer-assisted training and on-line educational platforms), by continuous training (the introduction of topics linked to the educational software programme utilisation in the educational curricula specific to the mandatory perfecting courses) and by financial constraints (the identification of grants that enable the purchase of such applications).

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S e c t i o n

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**

Inspiring Science Education – European Union Project

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Abstract

Inspiring Science Education is a project dedicated to all about providing the tools to make science education more challenging, more playful and above all more imaginative and inspiring for today's students, the citizens of tomorrow's world. Teachers, trainers, experts in Science education are working together to help them build a better world for everyone.

Keywords: Inquiry-based learning, inspirational digital resources, scientific research activities

1. Introduction

Inspiring Science Education is a pan-European project bringing together partners in 15 countries, including many experts in the field of Science Education. The mission of the Inspiring Science Education project is to provide digital resources and opportunities for teachers to help them make science education more attractive and relevant to students' lives.

Large-scale take-up amongst European Science teachers is the project's aim. Pilot activities will take place in 5000 primary and secondary schools in 15 European countries.

During these pilots, teachers will be accessing interactive simulations, educational games and eScience applications and integrating them with extra–curricular activities, such as field trips to science centres and discovery parks, and virtual visits to research centres.

Teachers will also have the possibility to access remote and online labs, and relevant scenarios for their use in the school classroom.

Students will be inspired to use eTools and digital resources to learn Science, Technology, Engineering and Maths (STEM related subjects) in a practical, competitive and exciting way "(http://www.inspiringscience.eu/project, accessed 2015)".

1.1 Partnership

The partners of this project are: AtiT– Belgium, Bulgarian Research and Education Network – Bulgaria, Cardiff University – United Kingdom, Consiglio Nazionale Delle Ricerche – Italy, Croatian Academic and Research Network – CARNet – Croatia, Dublin City University – Ireland, Ellinogermaniki Agogi Scholi Panagea Savva – Greece, European Physical Society, Fondazione IDIS - Citta della Scienza – Italy, Fraunhofer Institute for Applied Information Technology FIT– Germany, Helsingin Yliopisto Uhelsinki – Finland, Humboldt – Universität Zu Berlin – Germany, Institute of Accelerating Systems and Applications – Greece, Institute of Educational Policy – Greece, International University of La Rioja – Spain, Intrasoft International – Luxembourg, Learnit3d – United Kingdom, MENON – Belgium, NUCLIO - Núcleo Interativo de Astronomia – Portugal, Open University Guglielmo Marconi – Italy, SETApps – Greece, SIVECO – Romania, The Serious Games Institute – Coventry University – United Kingdom, Tiedekeskussäätiö Heureka – Finland, University of Duisburg-Essen – Germany,University of Bayreuth – Germany, University of Piraeus Research Center – Greece, University of Twente – Netherlands, Velti – Greece, Vernier Technology (Europe) – Ireland.

2 Why Inspiring Science Education?

Nowadays the studies are revealing the existence of a lack of interest in students' Science learning. They find the school science not relevant, even boring and unrelated to the world around them. Current school science leaves many students untouched in developing broad ideas of science that could help understanding of things around them and enable them to take part in decisions as informed citizens. The goal of science education is not knowledge of a body of facts and theories but a progression towards key ideas which enable understanding of events and phenomena of relevance to students' lives "(Harlen, 2010)".

On the other hand, an inspirational teacher can make wonders. Inspirational science teachers are at the heart of successful science teaching – ask any scientific Nobel prize-winner who had the greatest influence on their decision to become a scientist and invariably the answer will be – my Science Teacher! So what is it that makes a science teacher truly inspirational? That's one of the conundrums we aim to unravel in the Inspiring Science Education project. That's why we will be setting up workshops and exchanges, communities of practice and learning opportunities for science teachers and teacher trainers aimed at helping them find ways to make their teaching of science more inspirational "(http://www.inspiringscience.eu/project, accessed 2015)".

3 How to inspire Science Education?

This project goal is to motivate and to inspire the Science learning and that is why Inquiry-based learning (IBL) is used to embrace curiosity, fundamental human trait, as a natural impulse to learn and think. Inquiry-based learning (IBL) is a method of instruction that places the student, the subject, and their interaction at the centre of the learning experience. At the same time, it transforms the role of the teacher from that of dispensing knowledge to one of facilitating learning. It repositions him or her, physically, from the front and centre of the classroom to someplace in the middle or back of it, as it subtly yet significantly increases his or her involvement in the thought-processes of the students "(Lee May, 2013)".

In an IBL activity the students are: asking their own questions, formulating hypotheses, designing investigation, interpreting data, communicating in various ways, collaborating each other, asking new questions and reflecting on their knowledge, all with the support of their teacher. By collaborating in pairs and groups, students can share ideas and thoughts and so they can reach deeper understanding, social development and interpersonal skills.

The outcomes of such learning activities are: more motivated students, critical and higher order thinking, problem solving and deeper understanding of the world, good communication and collaborative skills, better retention of information, better, independent, adaptable and engaged students with research and analysis skills, more creativity and finally lifelong learners.

3.1 Big ideas of and about Science

Learning experiences should reflect a view of scientific knowledge and scientific inquiry that is explicit and in line with current scientific and educational thinking. Science education should aim to develop the understanding of a set of 'big ideas' in science which include ideas of science and ideas about science and its role in society scientific capabilities concerned with gathering and using evidence scientific attitudes. They are:

Big ideas of science:

1. All material in the Universe is made of very small particles. Light in all different wavelengths permeates the Universe. (This idea is slightly changed from Harlen's original)
2. Objects can affect other objects at a distance.
3. Changing the movement of an object requires a net force to be acting on it.

4. The total amount of energy in the Universe is always the same but energy can be transformed when things change or are made to happen.

5. The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.

6. The solar system is a very small part of one of millions of galaxies in the Universe.

7. Organisms are organised on a cellular basis.

8. Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.

9. Genetic information is passed down from one generation of organisms to another.

10. The diversity of organisms, living and extinct, is the result of evolution.

Ideas about Science:

11. Science assumes that for every effect there is one or more causes.

12. Scientific explanations, theories and models are those that best fit the facts known at a particular time.

13. The knowledge produced by science is used in some technologies to create products to serve human ends.

14. Applications of science often have ethical, social, economic and political implications. "(Harlen, 2010)".

3.2 Key outcomes of the ISE project

- access to online, interactive tools and digital resources from all over the world that can be used for science teaching
- templates, scenarios and methodologies to support science teachers and teacher trainers in their drive to make their teaching more exciting, fun and relevant for students
- a platform that can be used by students and teachers alike to take science teaching beyond the classroom and into the realms of extra-curricular learning
- a variety of eTools and digital resources that provide opportunities for students to collaborate with each other (in or out of the classroom) or with others outside of the class
- ways in which students themselves can be involved in scientific research activities
- a strong support network for teachers

4 Inspiring Science Education website

Through the Inspiring Science Education website (http://www.inspiringscience.eu/) and the activities organised by the partners, teachers can help students make their own scientific discoveries, witness and understand natural and scientific phenomena and access the latest, interactive tools and digital resources from within their classrooms.

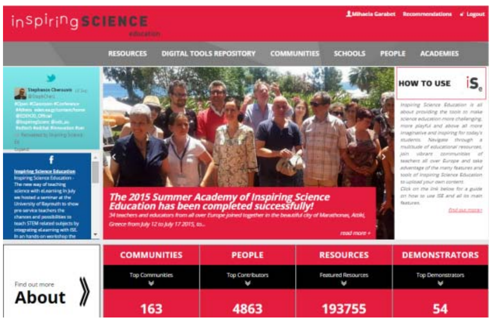

Figure 1. **ISE website**

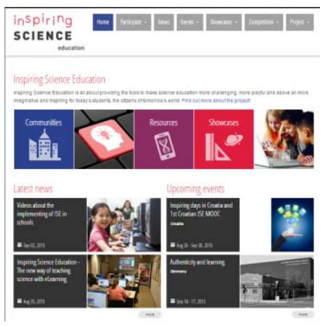

Figure 2. **ISE website**

The ISE portal is also hosting IBL activities developed by the 15 teams of partners by using some of the e-tools from the portal’s repository. They can be found here: http://portal.opendiscoveryspace.eu/ise/demonstrators, accessed 2015.

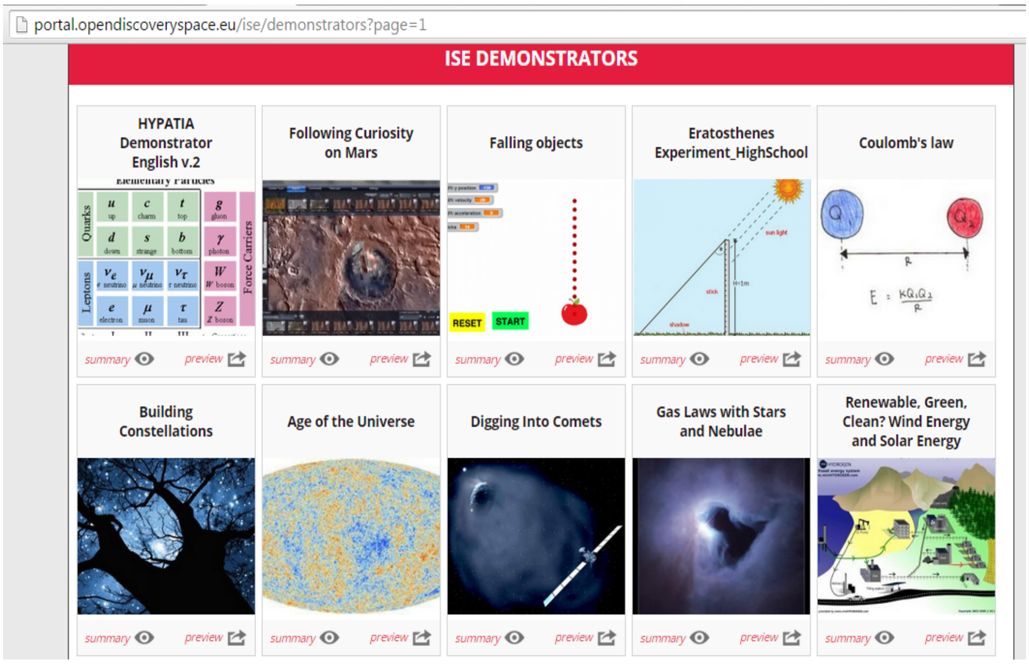

Figure 3. **ISE Demonstrators on ISE portal**

4.1 Romanian Demonstrators

Based on some of the Big Ideas of and about Science and using the WorldWide Telescope (http://www.worldwidetelescope.org/, accessed 2015), the Romanian team developed 4 demonstrators for Astronomy, Science and Physics lessons. Their names are:

- Following Curiosity on Mars (http://tools.inspiringscience.eu/delivery/view/index.html?id=d93824f5b89746c9bea155ba4b6fbd25&t=p, accessed 2015)
- The Blue Planet (http://tools.inspiringscience.eu/delivery/view/index.html?id=4ca6689c694143f6af473a71356c2abf&t=p, accessed 2015)
- Is sky the limit? - A journey between stars (http://tools.inspiringscience.eu/delivery/view/index.html?id=26cf0bfacc0647bfad1ffcecca235a6a&t=p, accessed 2015)
- Finding a new house for humans in the outer space (http://tools.inspiringscience.eu/delivery/view/index.html?id=b547e01954c4438a84f5026fe36803cd&t=p, accessed 2015)

For example, in Following Curiosity on Mars, students will follow the rover Curiosity on its way to the red planet Mars by using the World Wide Telescope. The didactical approach is based on scientific inquiry in order to give students the enjoyment of finding out for themselves and initiates appreciation of the nature of scientific activity, of the power and the limitations of science. The final product of the teams of students will be the presentation of a slide show created during their journey on Mars.

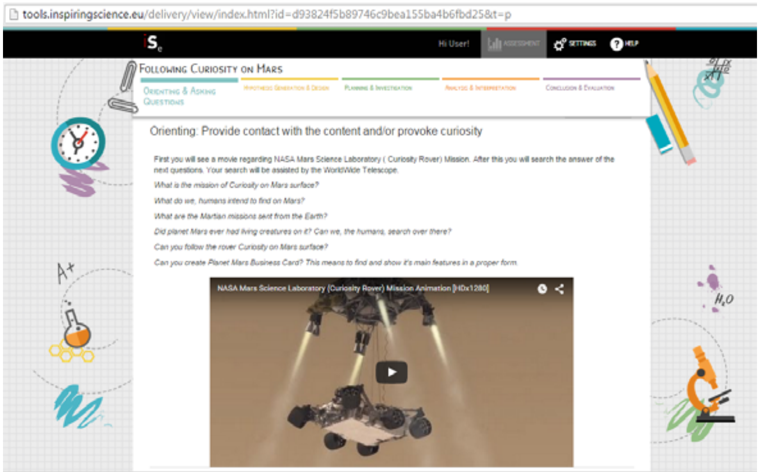

Figure 4. **Following Curiosity on Mars by using WorldWide Telescope**

5 Inspiring Science Education in Romania

The portal is hosting many communities of the science teachers. We created Romanian Science Teachers Community: http://portal.opendiscoveryspace.eu/community/comunitatea-profesorilor-de-stiinte-723629

Figure 5. **Romanian Science Teachers Community on ISE portal**

In Romania the ISE project was promoted to over 6,000 teachers and will enroll 417 schools until March 2016. Now the percentage of enrolled Romanian schools is almost 80%. We promote all the events from the project via e-mail, press release, on the website community and on Facebook, where we created the “Inspiring Science Education Romania” page “(https://www.facebook.com/pages/Inspiring-Science-Education-Romania/393269194159210, accessed 2015)”

Figure 6. **Facebook page of Inspiring Science Education Romania**

In the 2014-2015 were organized: two visionary workshops for teachers, one student's workshop and two practice reflection workshops. In the same time we created a National Contest of Inspired Science Lessons for teachers in partnership with INTEL (http://portal.opendiscoveryspace.eu/activities/723629, accessed 2015).

6 Further expected outcomes

The need to match school to digital mind (as it is demanded at the beginning of this century) has to redefine the characteristics and the expectations of the didactics.

All the stakeholders, students, parents, teachers and decision makers have to:

a) To have easy access to abundant and full rich multimedia information and full rich multimedia interactive learning content
b) To contribute to the production of e-content
c) To personalize product/services
d) To be connected (online)
e) To receive rapid feed-back

Comparing these "new" characteristics with the ISE measurable results we are full confident that this kind of projects should continue.

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A Fresh Restart? Google for Education in Romania: Effectiveness of Training Teachers in Using Google Tools for Teaching and Learning

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Abstract

While Google is providing some customised applications for free for educational institutions and for teachers, several accompanying initiatives are aiming to boost the usage of these applications and presumably to help teachers to meaningfully integrate them into learning. Teacher training programmes were started in several countries. In Romania, teachers were trained in 2014 and 2015 mainly through two specific courses, one face-to-face and one online. The paper presents the result of an evaluation researchon the teacher training programmes, conducted in mid-2015 by a team of researchers in education, with the purpose to provide stakeholders – teachers, trainers, education experts – withrelevant information about teachers' training needs, programmes` implementation, programmes` results and impact. Whichever the form of organization, the courses were very well received by the participants teachers, who found it helpful, complementing their pedagogical and discipline-related skills. With Google tools, teachers are more efficient in solving administrative tasks, they have more professional development opportunities, participate more in collaborative educational projects and succeed to create more interactive activities for their learners. Students participate more in activities including online applications, understanding better the learning content and being more creative.The evaluation reveals as well several downsides and bottlenecks in the transfer of the training acquisitions to everyday teaching and learning, related to managerial support, motivation, prerequisite skills. However, whilst not new to teachers and even less rooted in pedagogy, the training in using ICT tools to support their everyday teaching seems to have a new dimension when a big name such as Google is endorsing it, providing new incentives for education innovation supported by new technologies.

Keywords: teacher training, digital skills, teachers` competencies, ICT tools in education, computer-assisted instruction, training programme evaluation

1. Another teacher training programme to introduce ICTs

The initiative of Google to train teachers in using the ICT tools for education is part of Google for Education programme. In Romania, a framework agreement was signed with the Ministry of Education, with the overall purpose of "ensuring better preparedness of youth for professional life, through offering access to technology and training in using online tools dedicated to students and teachers in pre-university education".The teacher training component, aiming to prepare around 15,000 teachers in about two years, is ensured through cascade training, started by Junior Achievement Romania, the local organiser and coordinator of the programme.

Not being the first programme of this kind, it builds upon several layers of preparedness initiatives targeting teachers, started back in 2000 and supported by the Ministry of Education and companies such as Microsoft, Intel, Oracle, Siveco Romania, sometimes in partnerships with NGOs and governmental players.

From the beneficiaries perspective, Google training initiative reinforces the emphasis on education innovation assisted by the ICTs, from a slightly different perspective and using a different approach, quickly presenting the tools such as Google Mail, Calendar, Drive etc. within the training sessions, and leaving the exploration of possibilities to teachers, as a follow-up task, to be adjusted according to the area and level of teaching. Basically, the training content is a generic one and could be delivered to virtually any occupational domain` professionals such as medical staff, managers, scientists and so on; several exercises places the content within the education general context and link it with daily teaching and learning.

To what extent this approach is appropriate for a significant change in teaching behaviour and for reaching the overall ambitious goal of better preparing students for professional life?

2. Digital competencies for students and teachers

According to *Horizon Report -2014 Schools Edition*, one of the major imminent trends of the educational change is *the changing role of the school teachers as a result of the ICT influence*. The experts consider *that the focus on open educational resources (OER)* and the valorisation of both*, traditional and virtual learning methods* are expected to have a significant impact on schools in Europe, no later than 2017. *Students' digital competences andstudents' participation in designing the learning activities* are seen as both challenges and drivers of innovation and change in European school.

The panel experts have anticipated the time-to-adoption in school of technological developments that are expected to support the educational change: 2015 or before was the time mentioned for cloud computing and tablet computing (Google Apps for Education, Skype, Dropbox). In their opinions, the interest of the European school in cloud computer is increasing due to the rapid integration of cloud computing in our daily lives, through the expansion of mobile Internet and the increased use of devices expressly designed to operate in the cloud. Cloud computing has become an increasingly attractive option for delivering education services more securely, reliably, and economically. Its benefits of improving productivity and expanding collaboration in education are widely recognised.

Researches on the ICT use in education reveal that although the availability of ICT in school is increasing, teachers did not use the technology as expected (Aldunate& Nussbaum, 2013; Mehlenbacher, 2010; NESTA, 2012; Vrasidas, Glass &Zembylas, 2009; Wikan&Molster, 2011, apud Vrasidas, 2014). Most of teachers combine new technologies with traditional teaching methods.

In Romania, both initial and continuous teacher training programmes are providing teachers with ICT pedagogy and digital competencies. A number of researches and evaluations issued from 2004 onwards are available and revealing different stages of development, reporting progress on schools` organisational culture, in teachers` ability to integrate ICTs in educational situations, and as well regarding impact on learners` achievements such as key-competencies, school performance, level of autonomy, creativity etc.

3. Evaluation methodology and the sample

Carried out in May 2015, the investigation aimed to reveal the added-value of the teacher training sessions in using Google tools for education, which have been organised during 2014 and beginning of 2015.A comprehensive questionnaire-based survey – complementingthe review of the training curriculum and the analysis of all 18 online communities set up to support the follow-up process –targetedthe teachers who attendedat least one formal teacher training programme on using Google Tools for Education.

It should be pointed out that teachers were trained in 2014 and 2015 mainly through two specific distinctive courses, one face-to-face and one online, part of separate teacher training programmes.The questionnaire was distributed online, only through the communication channels used by participating teachers. 161 teachers responded to the invitation and took the survey. Additionally, 6 trainers provided more information on the development of the training sessions, the training content delivered, and the first-hand reaction of the participants.

The considered final sample comprised 159 teachers, distributed as follows: 78% urban teachers and 22% rural teachers; 6.3% kindergarten teachers, 20.1% primary school teachers, 25.2%gymnasium teachers and 48.4% highschool teachers; 19.5% of teachers having up to 10 years of teaching experience, 35.8% of teachers having from 11 to 20 years of teaching experience, 27.7% ofteachers having from 21 to 30 years of teaching experience, 17% of teachers having over 30 years of teaching experience.While around 15% of the respondent teachers took part in both conventional and online training programmes, 40.3% of the totalindicated the face-to-face training programme as the reference for their provided responses, while 59.3% of responding teachers referred to theonline training sessions.

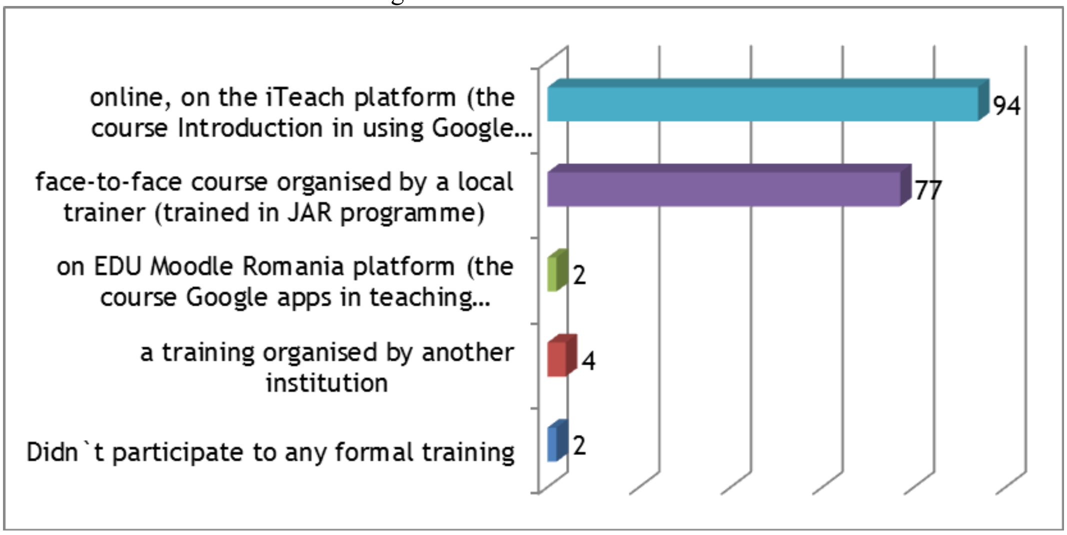

Figure 1. **Teachers distribution by the training program attended (N)**

4. The training process and the follow-up

The curriculum of anyteacher training programme should includethe pedagogical perspective, with examples of educational applications in the speciality discipline of participants – in other words, the final goal of the training should necessarily target the transfer of learning acquisitions into everyday teaching practice, facilitating it as much as possible. In reality, especially if the time allotted is scarce, the pedagogy is left aside, sometimes assuming that participants would figure out anyway an even better way to cope with specific challenges encountered in their classrooms. The analysis of the Google tools teacher training curriculum used in Romania suggests that in the 12-hours training the focus was on technology; however, according to the trainees' opinions, the mean on the scale 0-4 shows a balanced weight of all three elements, with the highest score for the technical aspects (3.48), at all educational levels – preschool education, primary education and secondary education, followed by pedagogical aspects (3.3).

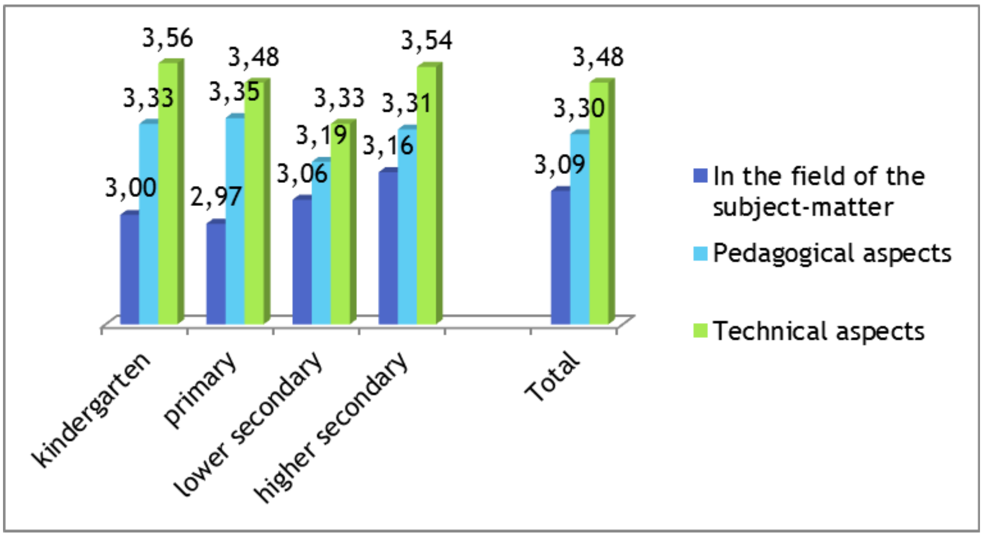

Figure 2. **The weight of pedagogical aspects, technical aspects and aspects related to speciality discipline, in the teacher training program. Distribution upon the educational level the respondents teach (averages on 0-4 scale)**

Within the training programmes, the trainees' participation in the online learning communities, specially created to support the use of Google tools in education, was encouraged. Almost half of respondents are members of the local Google Educator Group (49.7%). Most of them attended the online training program. 30.2 % of respondents, although not contributing with messages to the community, are following the message exchange between the community members. 13.9% of respondents contribute with messages/ comments to the learning community at least once a month.Theyperceive the usefulness of theirlocal GEG community as mainly linked with its function of offering support in using ICT, refreshing and updating the information acquired within the training (but not further developing the digital competencies), keeping in touch with colleagues:

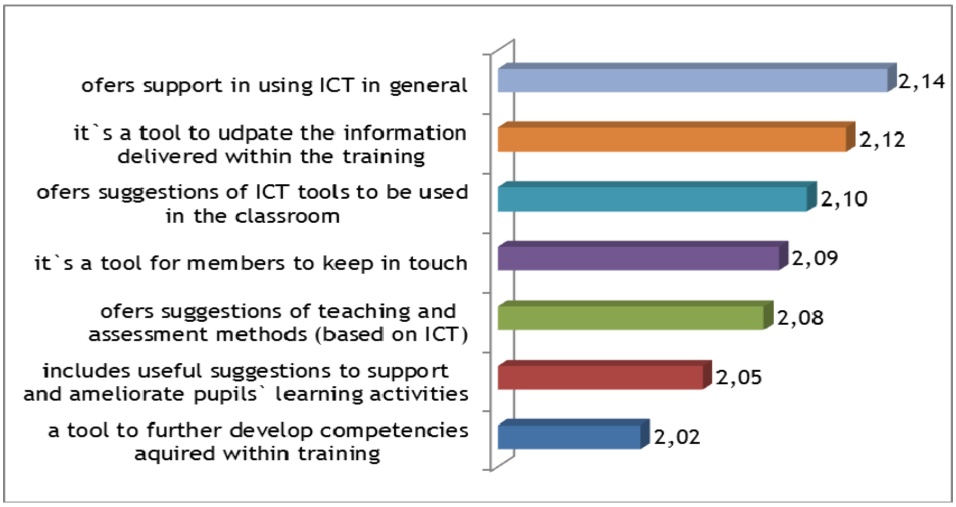

Figure 3. **Usefulness of Google Education Groups (GEG) perceived by the teachers trained (averages on 0-3)**

As stated in the programme`s objectives, the role of the Google Educators Groups is to build core-groups of leaders and champion teachers, interested in using ICT for education, able to further support their peers. While it is not very clear if this support is supposed to be exclusively related to the technical aspects, the analysis of the message exchanges in all GEGs is showing the focus on the technological aspects and in particular on the Google tools – or at least a neglect of the pedagogy associated with the integration of ICT tools in teaching and learning.

Although quite large, with an average of 100 members and some having up to 230 users, most of the existing GEGs in Romania are counting an exchange of around 2 messages per month, usually re-shares of announcements, without any other comment.Even though the enthusiasm of participant teachers determines high scores for all the suggested functions of the Google communities set up – all above 2, on a 0-3 scale – it is obvious that the actual usage of this powerful (training follow-up) tool is underused exactly regarding its mostly recognised need and its potentially highest added value – as transformingthe learning environmentand practices requires different layers of complementary processes and sustained support especially in pedagogy aspects (Velea, 2012).

Related to the level of teachers' satisfaction on the training program, 86.1% of the teachers graded the training course with 10. Among them 84.4% attended an online program, while 87.2% attended a face-to-face training program. 2.5% of all participant teachers rated the training program with grade 7 or less.Face-to-face training participants mentioned **insufficient training materials** and **the need for more practice on using Google tools** as motives for the lower score they accorded to the training course: *I think more hours are needed for practicing the Google tools presented by trainers;I could not understand all the tools within the course (e. g. Google calendar); More practical training is needed for Quizzes; Insufficient teaching materials; A training package would make the course complete.* Online sessions were criticized for the heterogeneity of the learning groups, the difficulty to work in teams, and thelarge amount of information transmitted in a short time.

Table 1. **Degree of satisfaction with the training course (% of total, by groups of participants)**

	The online course	**The face-to-face course**	**Both groups**
Grade 4		1.1%	**0.6%**
Grade 5			**0.0%**
Grade 6		1.1%	**0.6%**
Grade 7	1.6%	1.1%	**1.3%**
Grade 8	6.3%	2.1%	**3.8%**
Grade 9	7.8%	7.4%	**7.6%**
Grade 10	84.4%	87.2%	**86.1%**
	100%	**100%**	**100%**

5. Transfer of learning acquisition

18.9% of teachers have used the Google tools with their students once a week or even more frequently,25.8% of teachers once or twice a month, and 34.6% of teachers once or twice a semester. Thesedata are encouraging, given the limited time availability of teachers, between the training program completion and the participation in this evaluative study. Only 63% of the respondents graduated the course before the beginning of the second semester of the school year.

According to the evaluation findings**, the transfer of learning acquisitions** is influenced by several factors, depending on the environment where the school is located. Considering the responses ofboth, rural and urban teachers, the main critical factors are: *Poor material conditions in school*(e.g. ICT equipment) (mean2.38)and*lack of managerial support*(mean1.54).

School ICT infrastructure (e. g. laptops, tablets and netbooks; broadband; high connectedness etc.) is also presented as one of the critical factors that influence how successfully is ICT deployed in school teaching and learning, in the report *Survey of Schools: ICT in Education (2013)*. On the other hand, according to the report of theEuropean Schoolnet (European Commission, 2013),teachers' confidence in their own digital competence and their perceived utility of the ICT use in class help teachers to overcome the barrier of ICT equipment. Thus, teachers who were more confident in their digital competencies, but encountered difficulties determined by the school ICT infrastructure, have used ICT in class more frequently than teachers with few obstacles and less confidence. (Trends Shaping Education 2014, p. 6 , apudEuropean Commission/ European Schoolnet, 2013)

Beside the above mentioned factors, urban teachers face with *lack of students' motivation and interest (mean 1.43), low level of ICT competences of students (mean 1.24)* and *low level of students' knowledge (mean 1.19)*. The average ratings of the same factors indicate a slightly different situation in rural schools:*low level of ICT competences of students(mean 1.40)*; *low level of students' knowledge (mean 1.14), lack of students' motivation and interest (mean 1.00).* As expected, *the low level of ICT competences of students*is more demanding for rural than urban teachers, since disadvantaged backgrounds is considered one of the main factors of the second digital divide, according to *Trends Shaping Education 2014*(*ibidem*, p.3).

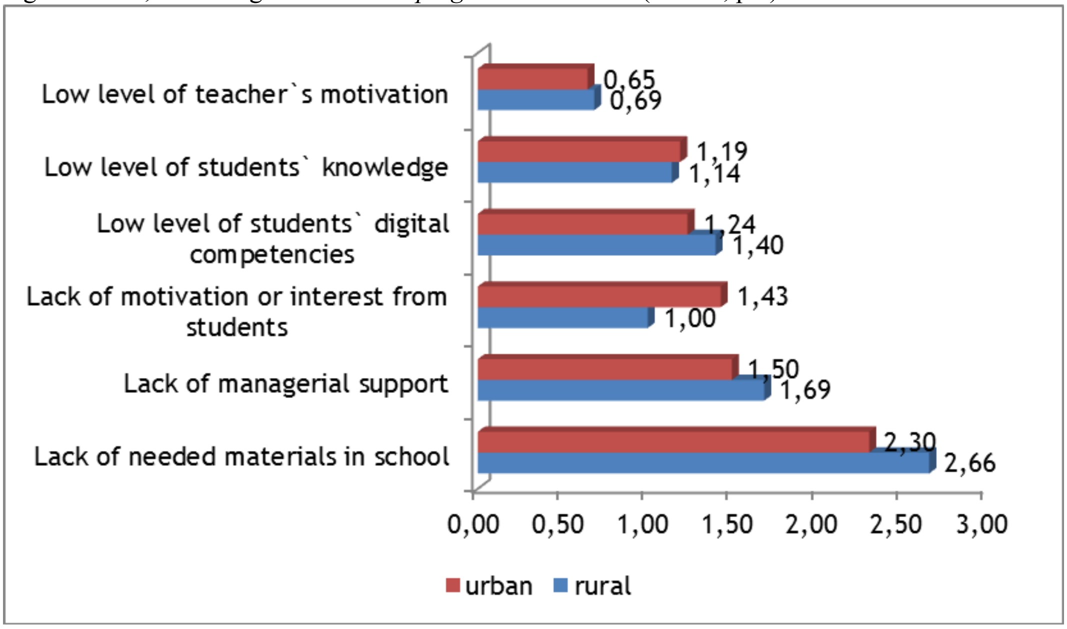

Figure 4. **Limits in transferring the learning acquisitions, rural- urban comparison (averages on 0-3 scale)**

A large majority of teachers have appreciated as significant the **role of the training program in changing the way they design and conduct the instructional activity**: *52.2% -to a great extent; 26.4% - to a very great extent.*

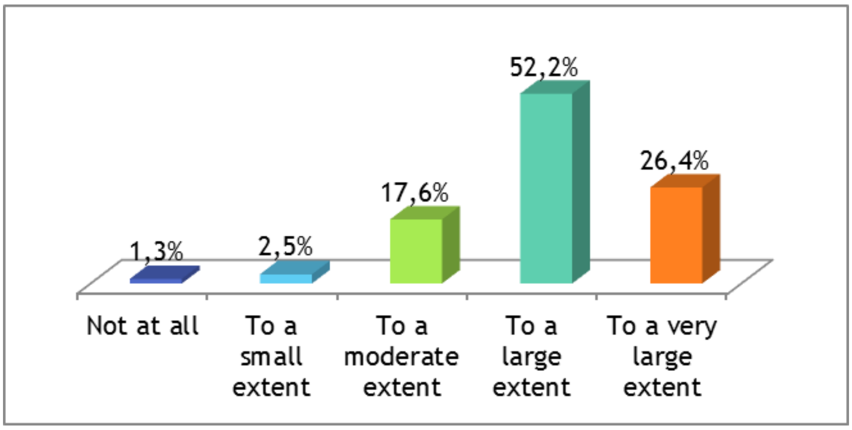

Figure 5. **Changes on educational practices as training outcomes**

The results show a high level of teachers'confidence in the program impact on the educational practices, regardless of their teaching experience. On the other hand, the highest frequency of the negative responses (*not at all* or *to a small extent*) was registered at respondentshaving less than 10 years of teachingexperience – 9.7%. Most likely, for those teachers, neither their digital competencies nor the confidence are the issues, but their perceived utility of Google tools for pedagogical goals. In our opinion, more attention should be paid to less experiencedteachers, in terms of technology-supported pedagogy, in order to integrate Google tools in the educational process.

Table 2. **The estimated impact on the design and conduct of the class (%) – by level of experience in teaching**

	Less than 10 years	11 - 20 years	21 - 30 years	over 30 years	**All**
Not at all	3.2%	1.8%	0.0%	0.0%	**1.3%**
To a small extent	6.5%	3.5%	0.0%	0.0%	**2.5%**
To a certain extent	9.7%	21.1%	18.2%	18.5%	**17.6%**
To a great extent	51.6%	49.1%	47.7%	66.7%	**52.2%**
To a very great extent	29.0%	24.6%	34.1%	14.8%	**26.4%**
	100%	**100%**	**100%**	**100%**	**100%**

6. Conclusions

The integration of Google tools into daily educational practices involves both good digital and pedagogical skills, enhanced by a good knowledge of the educational usage and potential of this technology.

As revealed by the teachersparticipating in the specific training programmes, Google tools are contributing significantly to making teachers more efficient in solving administrative tasks, in discovering professional opportunities and taking part inCPD, in creating more interactive activities for their learners. On their turn, students participate more in educational activities involving the usage of online applications, understanding better the learning content and being more creative.

The integration of Google tools into teaching and learning and its impact of the is yet to be monitored, and consequently the added value of the initiative of Google is still under evaluation. While the reach of the final scope is almost impossible to properly measure– given the ambitious goals, the difficulty to isolate variables, and in the absence of an initial evaluation or an adequate contextualised baseline – it is almost certain that the initiative triggered a new level of interest, refreshed teachers and students` enthusiasm, brought back in focus the desire to innovate education (situations), and complemented teachers` repositories of methods to address new generations of learners. Evaluation reports such as the one presented here would as well have their roles in supporting the integration of ICT tools into teaching and learning, towards a responsible use, significant and correctly designed from the pedagogical perspective, useful for (nowadays) learners.

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Interactive Learning Model for 3D Management of Geometrical Objects with Volume Constrains

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Abstract

This paper proposes the advanced study of the geometrical arrangement of spatial objects within a defined volume in order to get an interactive learning application. Both desktop scene and unit objects are defined by the user. The model design aims to support implementing a definition and spatial distribution of objects in a defined space.

Keywords: E-learning System, 3D Modeling, Virtual Design, Databases, Software Tools, Advanced Web Technologies

1 Introduction

This paper proposed the study of the geometrical arrangement of objects within a defined volume. Both desktop and objects can be defined by the user.

So far there have been proposed solutions based on Flash technology. The results were good to very good, but came with a number of limitations and disadvantages.

A major drawback is the very technology used, based on the Java Virtual Machine (JVM). Running the application involves installing JME. Another disadvantage is that the application runs exclusively the client side. That means that the performances are dictated by the performance of the computer application that is run.

The problem of scalability/updating is also present – it needs to edit the source file (.fla) in order to update the information. This means that that the person who does this is supposed to have advanced technical knowledge.

This article proposes a web based version of the application which solves all the above shortcomings. Advantages:

1. No need for any additional software, just a browser.
2. Performance is improved since the calculation is performed on the server (via PHP), by running client side JavaScript.
3. The total scalability through MySQL technology (the code remains unchanged, updating the database only [6], [7]).
4. No need for user technical skills.

The application is based on technologies such as MySQL, PHP, JavaScript, jQuery, HTML5, CSS3 [6], [7]. In the following we will present some general aspects of the conception and design, as well as details on how to use the application in a specific study case.

2 Designing the e-Configurator application

2.1 The main goal

The e-Configurator application [2] aims to support implementing a definition and spatial distribution of objects [3]. In the first step, the objects will be described using a quadrangular prism shown in Figure 1 [1].

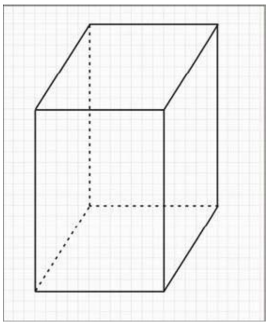

Figure 1. **The initial model of the graphic object**

This model allows to study of the spatial distribution after the three axes (X, Y, and Z) and will be defined by three dimensions: width, length and height [5].

2.2 Constrains and object manipulation

The first natural constraints are referring to interleaving objects in a given space. Therefore, an algorithm of locating the objects is needed. It is called the object motion detection and it will have to calculate the new position of the object in order to determine whether it is possible to place it in the new location or not. This involves maintaining a data structure with all the positions of objects in the current scene. Besides individual object translation the application multiple objects (group) translation. Again, an algorithm that has to calculate the surface area created by the objects in the group is needed. This will be determined by the maximum projection on OY axis and the sum of the projections on OX axis for the objects from the group, as shown in Figure 2.

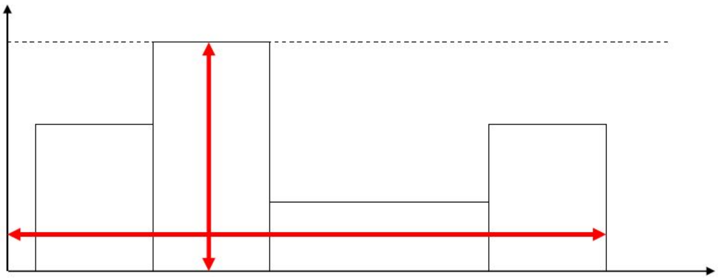

Figure 2. **Determining the area of the objects group in the XOY plan.**

Other way of handling the objects is their rotation. Using the present model of objects, the rotational operation is unproblematic because anyway the object is rotated, it will occupy the same volume in space. It should be noted that the object can be rotated only on the OY axis, this being in the category of system constraints.

In addition to translation and rotation operations, the user will benefit from a series of algorithms to streamline the spatial arrangement of objects. Two types of constraints are defined: natural constrains and system constrains. Some examples of natural constraints have been presented above. The system constraints are user defined, facilitating an easier object disposal, as shown in Figure 3.

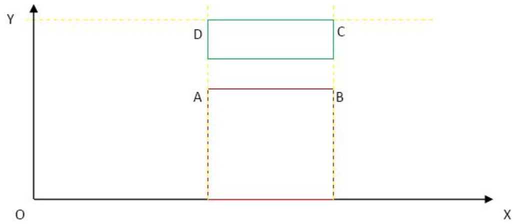

Figure 3. **The constrains role in the object spatial disposal.**

Let us suppose that we want to locate the green object over the red object. The decision algorithm should follow these steps:

Step 1. Determine the area formed by the points ABCD;

Step 2. Verify that the area formed by the points ABCD is greater or less than the area of the green object (natural constrain);

Step 3. If yes and if there is no system constraint (e.g.: “green objects are not to be placed above red objects), then place the object;

Step 4. Otherwise, the user will be notified with an error message, and shall specify the nature and cause.

Besides the listed facilities, the application also features a system of measurements and the possibility of exporting the arrangement made. The optimization algorithm of spatial location of objects will have to consider both types of constraints, natural constrains are a priority, then system constrains. A simple example of the operation of the algorithm optimization involves the list of selected objects to the spatial distribution, sorting them in ascending order, based on the minimum between the values of their projection on the two axes of the plane where the location is made (e.g., OX and OY). The next step is their location in order to occupy a minimal space.

3 Defining the objects and their relationships

Defining objects is made following a tree structure.

- Suspended/built-in objects / Ground objects:
  - Items with swing/tilt-turn components:
    - components opening below 90°
    - components opening below 180°
  - Items with sliding components
  - Unit-body objects

Depending on the category to which it belongs to, each object needs defining additional attributes/information in order to know exactly its volume.

Let us consider, for instance, the *window* object. It falls into the category of Suspended/built-in objects → Items with swing/tilt-turn components → Components opening below 90° or 180°. Depending on the type of window, the defined volume can be different, as shown in Figure 4a and 4b.

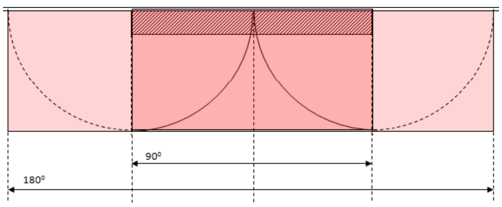

Figure 4a. **2D view: representing the window with components opening below 90° or 180°.**

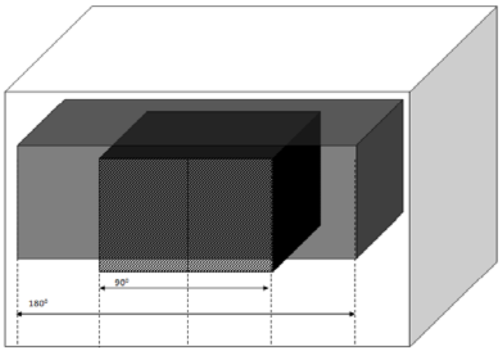

Figure 4b. **3D view: representing the window with components opening below 90° or 180°.**

Based on the *window* model, the *door* and *wardrobe* objects will be treated. Objects with swing components will constrain the spatial location of neighboring objects, following the previous *window* model.

The objects with sliding components are represented in Figure 5. The constraint imposed by sliding components means doubling the volume of the object by sliding.

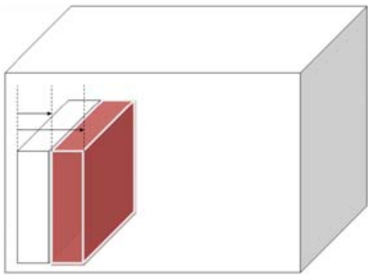

Figure 5. **3D view: representing an object with sliding components**.

Besides the natural constraints (imposed by objects structure) in the e-Configurator application constraints can be user defined. Examples: the location of the *table/desk* object in front of the window. This constrain involves identifying the wall with window and selecting the opposite wall. After treating this initial constrain, we proceed to treat other natural/user-defined constrains. As for operation order, the first objects to be treated are the ground-placed objects and the next objects are to be treated with respect to those.

4 The computational algorithms for the available volume in the scene

When adding a new object in the scene we need to check whether there is sufficient space for it, and if so to calculate the position where it can be placed. The user has 4 different areas to start the search gap into: NW, NE, SW, and SE.

The algorithm is based on matrix operations [4], which will be described below. The stage is seen as an $m \times n$ matrix, where $m = n =$ width and height. Arguments to call the function with for calculating the space available are:

1. The size of the object for which the search starts to get the available space.
2. The size of the scene.
3. The size and position (position of the upper-left corner) of all the objects related to the current object (the one for which the search for available space starts).
4. The variants of grouping the objects.

The scene matrix is initially filled with 0's, thus representing the blanks. Then the algorithm scrolls through the list of related objects (if any) and overlaps an all-1 matrix with scene matrix corresponding to positions of each object in the list.

The algorithm for computation of available space has gone through several stages of development/improvement. The scene matrix is scrolled in order to identify the first line where there is at least a free position (the unit chosen is 1 pixel). This particular line is scrolled to the first zero position.

From this point the algorithm tries to form a matrix of 0's diagonally traced, as represented in Figure 6.

As illustrated in the example of Figure 7, at position (2,0) the algorithm identifies the first zero. The upper-left point is noted by position (top, left) = (2,0). It continues checking diagonally.

For position (3,1), as represented in Figure 7:

- Check if element (3,1) is zero;
- Check if elements (top i-1, j) and (i, left: j-1) are zero,
- where i is the line index and j is the column index in the matrix.

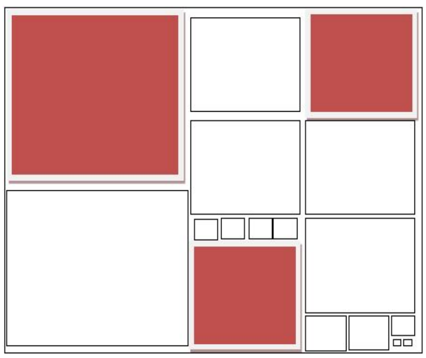

Figure 6. **Scrolling the scene matrix to form a matrix of 0's.**

0	1	2	3	4	5	6	7	8
1	1	0	0	0	1	1	1	1
1	1	0	0	0	1	1	1	1
		0	0	0	1	1	1	1
					1	1	1	1

Figure 7. **The resulted matrices in the process of forming a matrix of 0's.**

This way, the first matrix of 0's is formed. After saving the starting position and its size, the algorithm marks all elements as 1 (signifying that the matrix is located so that it will be avoided in the next iterations for other possible solutions).

Next, the algorithm tries to form a new matrix. If it identifies a new zero, the process repeats as described above. Otherwise, if the end of the line is reached, it recalculates the first line with at least one zero then the above process resumes. The matrices of 0's (obtained by running the algorithm) are represented using different colors.

The default search method starts by seeking from NV (the upper-left corner). As mentioned above the user has available three other options: NE, SE and SW. Each of them is based on the algorithm for the case NV, with some modifications.

A solution is defined by four attributes: (*top*, *left*, *width*, *height*).

Let us note the size of the sought object *myW* and *myH* and the size of the scene matrix *layoutW* and *layoutH*.

For the NE case, the matrix is vertically mirrored. The obtained solutions needed some adjustment as follows:

[1] $(top, layoutW-(width+left)+(width-myW), width, height)$

For the SE case, the matrix is horizontally mirrored. The obtained solutions also needed some adjustment as follows:

[2] $(layoutH-(top+height)+(height-myH), left, width, height)$

For the SW case, the matrix is both horizontally and vertically mirrored. The obtained solutions also needed some adjustment as follows:

[3] $(layoutH-(top+height)+(height-myH), layoutW-(width+left)+(width-myW), width, height)$

5 Optimization of the scene volume distribution

We will present two approaches aimed at solving the same problem, namely the optimum disposal of objects in a defined scene.

The first approach is classic, the users are allowed to add to the scene all the items they wish to have. After creating the pool of objects, each of them is individually analyzed and the corresponding occupied ground area is calculated, according to intrinsic and user-defined restrictions. The footprint of each object is calculated through a weighted sum of their parameters (constraints). Next, the footprints are decreasingly ordered, according to previously calculated sums. The result is a vector of objects decreasingly ordered.

The scene area is seen as an $M \times N$ matrix, where M and N are the stage dimensions. The accepted conversion is 1 cm = 1 pixel.

Initially the scene matrix is all-zero (M, N). The vector of objects is scrolled, where each object is represented by an A × B matrix, with A and B representing the dimensions of the object. The matrix is filled spirally with each matrix of the current object (obtained in the current iteration).

Using a matrix as the object model allows further refinements of the algorithm: the evolution from the cubic model to models much closer to the physical object using two matrices for each object: one in the XOY plane and one in the XOZ plane. Browsing a matrix is based on the simple idea of attending spiral arrays [5].

The second approach is similar to that described above. However, it presents a fundamental difference: the algorithm reacts in real time to input provided by the user. The algorithm "follows" any change in the scene, so that adding a new object will result in recalculating the objects positions taking into account the new constraints.

6 Study case: optimal disposal of objects in a living room

Let us consider a 932×500 pixels scene filled with 11 objects from 7 different categories.

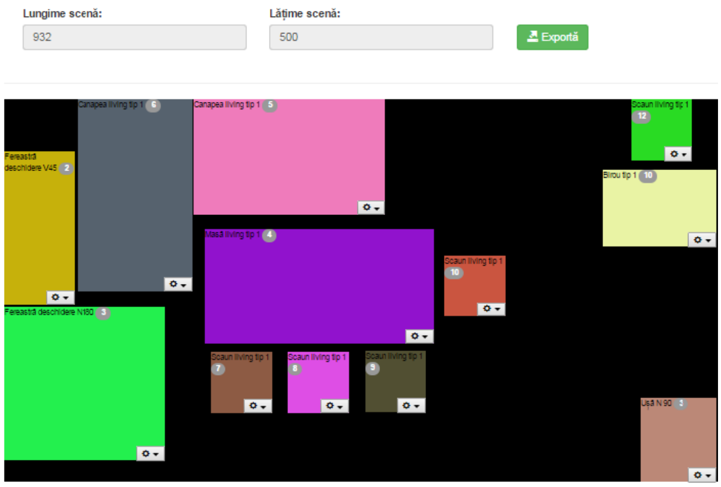

Figure 7. **The result obtained by e-Configurator in order to place objects in a living room.**

Let us start the arrangement by placing in the scene the windows and the door. Two different types of windows were selected: with components opening below 90° and 180°. It can be seen that the space occupied by the two different types of windows differs. They were placed in W corner of the room. The door was placed in the SE corner of the room, choosing the "Sort objects to SE" insertion mode. The insertion method selected for placing the two sofas was "Sort objects to NW". One of these was rotated with 90° from the initial position to form a bracket with the other one. In the proximity of the two sofas a table and four chairs were added. The insertion method selected for placing a desk and a chair was "Sort objects to NE". If the user wants to optimize the arranged space, the objects in the scene can be grouped scene after one of the four available directions; NW, NE, SW or SE. Next, the replacement can be customized manually by the user. The result is a placement with maximum area of continuous related space, as represented in Figure 7.

7 Conclusions

We have introduced a parameterized algorithm for placement of objects in the scene, optimized to achieve a maximum related space. The algorithm is based on the matrix method both the scene and the objects being represented by matrices of sizes equal to those of the scene / the objects. The scene size is configurable (customized) in order to provide the user with an experience in the simulator as close as possible to reality.

The application can bee seen as an e-learning system aimed to create a virtual tool that allows users to optimize the placement of fixed-size geometrical objects in a defined volume with different types of constrains in order to obtain a customary improved disposal of available space. The users can select a preferred zone for adding new objects in the scene, using four directions: NW, NE, SW, and SE. Besides the possibility of translating objects, the automatic objects placement is available, starting the selection from one of the four corners of the scene. Once fully completed the 2D representation, we will consider integrating a library with which the application can render live (in the browser, not in the server) 3D objects, in order to get a more realistic experience.

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A Complex iOS Mobile Learning Platform for an Archaeological and Architectural Management System of a Cultural Heritage Site

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Abstract

This paper proposes a complex learning system of archaeological and architectonic management of a historical site. The project can function as a tourist virtual guide, but it can also facilitate the specialist efforts to update an archaeological and architectonic database, if a mobile application implements all these features. The paper describes the conceptual and technological aspects of the new created management for the learning system based on a set of requirements needed to be implemented on the mobile iOS platform.

Keywords: E-learning System, Archeological Site, Architectural Management Platform, Virtual Class, Mobile Application, Database, Advanced Web Technologies

1 Introduction

RM360 represents a project developed in collaboration with Architecture Restoration Archaeology (ARA) and Alburnus Maior associations and its main purpose of the released pilot project is creating a complex system of archeological and architectonical management of the historical site from Roşia Montană (RO).

Based on our own expertise of the previously released pilot project (RM360 Beta version), we came to the conclusion that the project can become more popular, more accessible and it can function as a tourist virtual guide, but it can also facilitate the volunteers struggle of updating the archeological database, if an mobile application will implement all these features.

This paper describes a new created management system based on a set of requirements needed to be implemented on the mobile iOS platform.

The iOS app has as its main features the following:

1) Implementation of a register&login system that has the possibility to join the app based on different types of users. The users can use the app in *tourist mode* or *architect mode*.
2) Implementation of QR decryption method for the QR codes that are posted near every archeological site.
3) Accessing and displaying relevant information from the server's database, based on the scanned QR codes.
4) Implementation of a map system that can display the user's location and the location of the previous accessed site. This map system will be displayed as: standard, satellite and mixed.

Implementation of an input data flow - the user will be allowed to update the server's database with all the details of the every new site when logged as an *architect*.

2 Concept, design and application content

2.1 IDE, programming language and application architecture

For developing the app on the iOS platform [2], we used Xcode IDE [7]. An Xcode project represents the source of an application and it contains the whole collection of files and settings used for building the app. In order too program in iOS mobile platform, we need to *communicate* with the iOS. Everything we send to iOS must be in conformity with the iOS API (*Application Programming Interface*). API is a list of specifications that ought to be implemented in order to communicate with iOS [3], [4], [5], [6].

Therefore, C programming knowledge is necessary for two reasons:

1) The majority of the iOS API require Objective-C language. Objective-C implies C language because it represents an object oriented language based on C.
2) Some iOS API require the usage of C more then Objective-C. Frequently, C function calls and data-structure are used.

When developing the app, we have implemented the MVC (Model-View Controller) Design Pattern. *Model-View-Controller* represents a software architecture model for implementing the user interface. This concept is based on dividing a software application in three interconnected parts. This concept was introduced by Trygye Reenskaug, Smalltalk programmer, in 1979 [1].

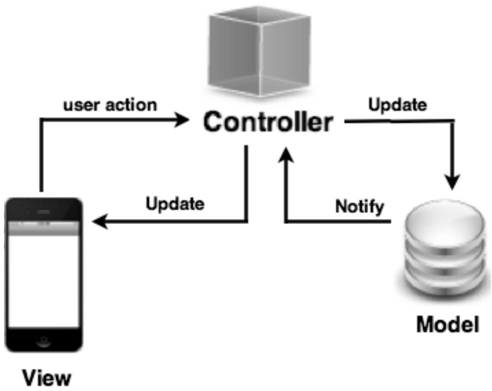

Figure 1. **The MVC structure**.

As its name suggest, the app is divided in *Model, View* and *Controller*, as seen in Figure 1. The main advantage of the MVC is *reusability*; you can reuse the same *Model* for many other *Views*.

In the *Model* part of the developed application, we included a set of classes where we have implemented different methods such as validation field methods for the authentication and register text fields, but also methods of creating a pin point annotation on the map, using *Mapkit*. The *Model* objects take their data from either databases or local/external files. A *Model* does not *speak* directly with a *View* but it is made available for the *Controller* in order to be accessed when needed.

In iOS, an example of a *Model* is represented by an *NSObject* or, in case of a *Core Data* (an iOS framework which allows saving data in a local database on a mobile device), a subclass *NSManagedObject*. Each *Model* object contains instance variables and getter/setter methods. Most of object-orientated languages have a mechanism which provides encapsulation; in iOS, encapsulation is provided by a property and the keyword *synthesize* automatically generates the setter and getter methods.

The *View* displays the information contained in the *Model*. Although the *View* does not obtain information directly from the *Model*, it uses the *Controller* which instructs it what and when to display info. In iOS, almost all *Views* inherit from *UIView*, which offers the capacity to manage the touch screen events or drawing. The *UIKit* framework contains classes that can draw typical interface elements such as buttons, text fields, tables, grids and so on.

Finally, the *Controller* is responsible for accessing data from the *Model* and displaying it in the *View.* The same *Controller* can be used for making the link between many *Views* and *Models*. The *Controller* controls the interaction between the user and the *View* and communicates all the changes to the *Model*. On the other hand, the changes from the *Model* are observed by the *Controller* and subsequently reflected on the *View.* The *Controller* is the place where all app stands. In iOS, the *Controller* is frequently a class of *UIViewController*, which organizes the *View.* It is also responsible for the delegate messages and target-action messages.

In the architecture of the iOS project that we have implemented, we added a folder which contains photo and audio files but we also added a folder where we keep a series of frameworks used in the project. The architecture is described in the Figure 2.

2.2 The first screen of app implementation

The first screen of the app contains the authentication part. In this screen we put: two *UITextFileds*, where the user must tap on and enter the username and the password; the registration button, and the login button.

Here is the flow: The user enters in the text fields a username and a password, and then he/she taps on the *Login* button. On this button action, we call a set of validation methods. In the *Model* part of the app we implemented the following methods in order to restrict the user:

1) The text from the both text fields must contain minimum six characters;
2) The text fields must contain only letters, numbers and the characters: <_>, <->, <.>;

The first character of the text fields must be a letter.

If after tapping the *Login* button, the entered text of each text field is being validated by the methods 1), 2), 3) and if it passes, the app sends a *POST* request to the server containing a dictionary with *Username* and *Password* keys and as values, the texts introduced by the user into the text fields.

In order the process of authentication to run, the request was made on the main thread of the app because blocking the user interface was needed in order to pass to another screen only after receiving a response from the server (the validation message of the user authentication). After receiving the response message from server, and there are no other errors, the user is logged into the app and redirected to the core of the app – the main screen (screen number three). The *Register* button's action redirects the user to the second screen – the *Register* Screen.

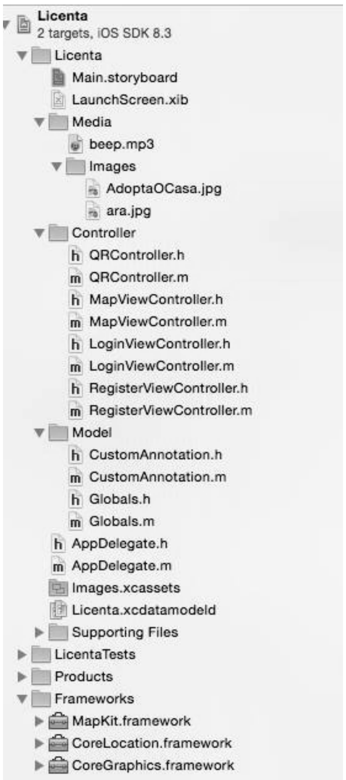

Figure 2. **The MVC implementation.**

2.3 The second screen of app implementation

The second screen is where the *Register* feature is implemented. The screen has four text fields (*Username, Password, Confirm Password, Email*), and the *Register* button.

Here is the flow: the user must complete all of the text fields then he taps on the *Register* button. This button's action calls the validation methods described in the first screen plus an email validation. If the texts entered are valid, a synchronous request is sent to the server. This request of type *Post* contains a dictionary with specific keys for each value entered in the text fields. After receiving the response message from server, and there are no other errors, the user is registered and redirected to the first page in order to begin the *Login* process.

2.4 The third screen of app implementation

As depicted in Figure 3, the main screen has an *AVCaptureVideoPreviewLayer* which is a view that displays a rear camera, a label where the decrypted code will be displayed and a *Start/Stop* button.

Here is the flow: the user can tap on the *Start* button and the camera is now available. One can scan the QR code found near the archeological site and after the scan is completed, a request to the server will be made and it will contain in its body a key/value dictionary with the result of the decryption. When we implemented the QR decryption algorithms, we have used *AV Foundation* framework. With this framework, we created an *AV CaptureSession* object and then we used the metadata object in order to capture the *AV Metadata Object Type QR Code*. QR code reading can be stopped at any time and we also used sounds that are played when the decryption succeeds or the process is being cancelled.

When the QR code is decrypted, the message is shortly displayed in the *UI Label.* Once the process succeeds, we implemented a *Post* method using *NSURL Connection* in order to facilitate once more the communication between the app and the server's database. The response message to this request is a dictionary which we de-serialized using *NSURL Parser.* The dictionary contains the name of the archeological site, the GPS coordinates, the historical information, and the URL of the associated image. Once the data is parsed, we redirect the user to the screen depicted in Figure 4, performing a specific *segue* provided by the *Storyboard* (UML class representation of iOS project).

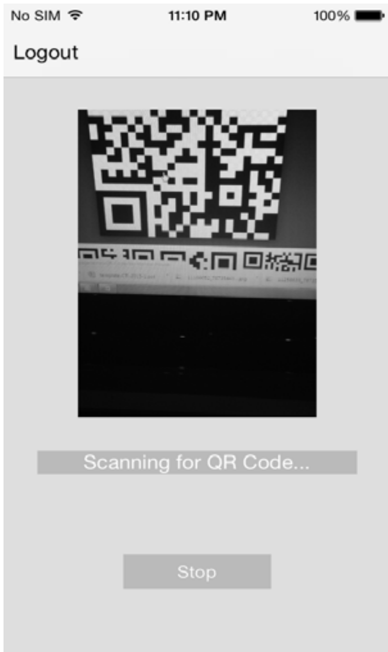

Figure 3. **The main screen.**

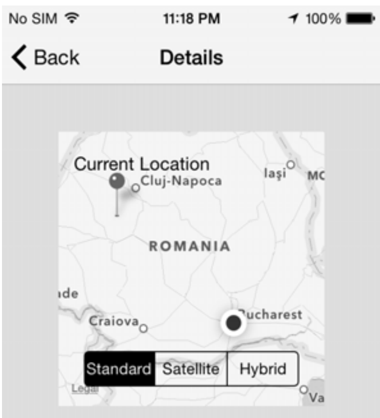

Figure 4. **The details screen.**

2.5 The fourth screen of app implementation

As depicted in Figure 4, at the current moment, the *Details* screen of the app contains only the map displayed using iOS's map framework, *Mapkit*.

Here we have implemented a series of features as mentioned below:

1) Display current location;
2) Display the archeological site location;
3) Implemented three ways of visualization: Standard, Satellite and Hybrid;
4) Implemented *Go to current location* feature.

We started by adding the *MKMapView* and then we implemented the framework mentioned above. The implemented map can be tapped and scrolled up to a span that we chose (a certain height).

In order to communicate with the GPS sensors, the framework and the internet connection, we added a *CLLocationManager* and updated it every time the user changes his location. When implementing the *displaying location* feature and *go to current location* feature, we implemented a method to zoom to the desired point on the map using the *MKCoordinareRegion.* Therefore we needed a span region which we have created using the values found based on attempts to make it user friendly.

The site's coordinates were displayed making a pin annotation with the desired coordinates, and a title. We made it user friendly by showing some information on tap event. In this screen the images received via *segue* from the previous controller will be also displayed. The images will be related on the archeological site objectives.

Along with the images, a *TextView* will display the history of the site objective and other relevant information.

2.6 Other implemented features

The app has some extra features:

1) Auto login – we used the *NSUserDefaults* class in order to save the user's details after logging in for the first time. Now when the app is closed and reopened, the user will be automatically authenticated by making a request with the saved credentials.

2) Logout – the user can log off from the *Main Screen* and will be redirected to the first screen.

3) Implemented constraints on each view's objects in order to make the app available on all of the Apple's devices such as: iPhone 4, iPhone 5, iPhone 6, iPhone 6 Plus and all iPads.

4) Internet detection – we implemented a method that has a block that makes a request to Google and then, based on the response type, we decide if the device has an Internet connection or not. If the device has lost the connection, we display a *UIAlertView* with a conclusively message in order to inform the user about the issue.

5) Image resizer – when we parsed the URL image received from the server, we have realized that large images can block the user interface and that gives the frozen aspect. Therefore, we made an image property and when passing to the *Details Controller*, the *UIImageView* where the *UIImage* will be displayed is now resized to the image's best aspect size ratio (best case is aspect fit). After this operation, we scaled the image to the size of the *UIImageView* making a *Core Graphics* rectangle with the size previously acquired and then drawing on the corresponding *Core Graphics Image Context*. After implementing these operations, we managed to resize any kind of image size to a maximum size of 300 KB. This operation ensured a clean flow and substantially reduced the memory occupied by the app.

3 Conclusions

The app is fully operational and requires minimum resources. The app can operate on multiple devices. The processor of the iPhone 5 (developer phone used) stays on 1% when the app is running, and the memory occupied by the app when running is up to 15 MB.

At the current moment, the second part of the app is in developing progress. The second part of the app is called *The Architect Mode*. When authenticated as an architect, the user can upload relevant information of the site to the server's database (after that, both the web page and the app will be instantly updated). This feature of the app requires additional camera access, image resizer, getting local region coordinates (GPS), different input types, but also optimization on sending the information to the server (for example, sending multiple images using multipart HTTP POST).

If the first part of the app described in this article is focused on increasing the tourism in the Roşia Montană area by the mean of an e-tourism mobile application, the second part is focused on developing a virtual learning application as a complex system of archeological and architectonical management of the historical site from Roşia Montană. It reduces the specialists and volunteers work, eliminating the need of creating individual cards/files for each archeological site. It also eliminates the need of using a GPS device for both tourists and volunteers, making their visit more pleasant and their work easier, respectively.

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The Influence of Database Engines in Distributed Committee Machine Architectures

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Abstract

The database management system storage engine is a software structure that deals with storage, handling and obtaining data for a particular table. The most suited data mining architecture for knowledge discovery in a distributed database is the distributed committee machine. Distributed committee machines are a combination of neural networks that are arranged in a distributed manner on multiple computing systems in order to resolve a given data mining task. In this paper we study the interaction between the distributed committee machines structures and the database engines used for storing data. In the tests that were done we were interested in analyzing solely the writing operations that are made by all the distributed slave systems on the master server. We study through performance tests if the mechanisms for managing concurrent access to a database implemented into a real database engine can affect the functioning of a distributed committee machine. This research is important for study fields such as distributed learning, astronomy, artificial intelligence and many others that imply the mining of large distributed data sets stored in distributed databases.

Keywords: Knowledge Discovery in Distributed Databases, Data Mining, Distributed Learning

1 Introduction

The Knowledge Discovery in Databases(KDD) represents the process of analyzing and finding useful information in large data repositories. Data Mining(DM) is only one step from the entire process of finding useful data and it represents a set of specific methods and algorithms for extracting information from preprocessed data (Fayadd, U. et al, 1996). Knowledge Discovery in Distributed Databases (KDDD) is an extension of the usual KDD process and it represents the discovery of useful information through a DM task in distributed databases. In the research that I have done I found that the best DM architecture that can be used when working with real implementations of distributed databases are the Distributed Committee Machines (DCM). DCMs are a group of neural networks spread across multiple systems used for obtaining better results in terms of the chosen DM task(classification, regression and so on). Usually, all the research that is made in this field does not consider real implementations of distributed databases. This paper will take into consideration the real distribution of data on multiple machines through the replication process. In the master-slave replication topology, the replication process means that all the data from the master server is replicated on every slave machine. If a transaction occurs on the master system, it will be also be executed on the slave machine in order to have the same data on master and on the slave system.

The design of an DCM implemented in a real replication topology is represented in Figure 1.

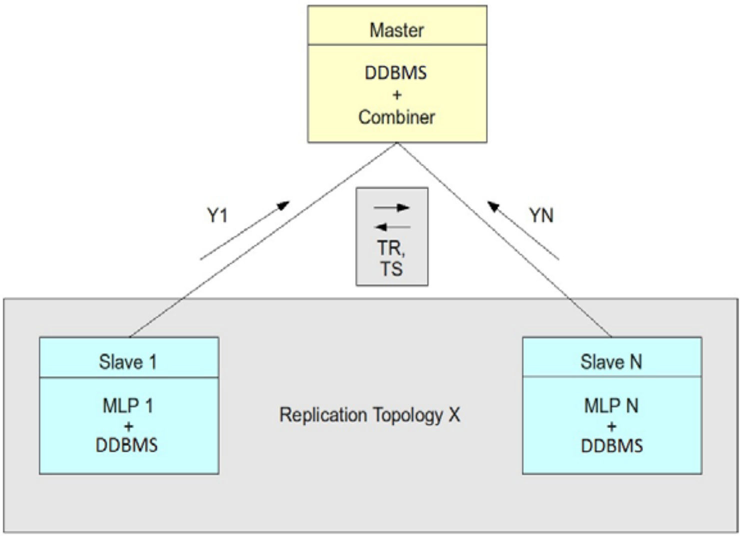

Figure 1. **DCM implemented in a master-slave replication topology (Pupezescu V., 2015)**

In this design, the combiner sends the configuration parameters of multilayer perceptrons(MLPs) on each slave system. The next step is the actual DM task that is taking place (classification in my research). The best results (Y1, Y2, ..., YN) from the distributed systems are then taken or combined by the combiner module from the server.

The advantage of this architecture is the fact that all the results and all operations are transmitted from the slave machines on the master system. Through the replication process nothing is lost because all the data is duplicated on each machine. This approach is very useful when DM tasks are applied on large data repositories. In a large neural training process on large data sets it very important to have failover capabilities for the entire distributed system. This is easily achieved through distributed databases. The problem with distributed databases is that the overall design should be optimized in order to obtain very good results in terms of execution speeds(Pupezescu V., 2015). The replication types should be taken into consideration also(Pupezescu V., 2015).

In this paper I will study how the distributed committee machines architectures are influenced by database engines and by concurrency mechanisms in one of the most used Database Management System: MySql. I will study only the writing operations that are transmitted from the slave machines to the master server.

2 Database storage engines

DBMS storage engine is a structure that deals with storage, handling and obtain data for a particular table. All storage engines have their advantages and disadvantages, none of which is the solution for all users options (DuBois P., 2006). MyISAM engine has long been the implicit option for storing the data in tables. Data managed by this engine are kept in three files: each of these files have table name but have different extensions. In the .frm file is stored the table format, in .myd is stored actual data file, and file indexes are stored in the .myi file (DuBois P., et al, 2005).

InnoDB is the default engine starting with version MySQL 5.5. It complies the ACID model (atomicity, consistency, isolation and durability) and recovery facilities of data in case of problems. Locking mechanisms for data and consistent readings allow the achieving the best performances by ensuring concurrent transactions on tables. The InnoDB storage engine arranges data on the disk in such a way that it allows query optimization based on indexes. In order to maintain the integrity of data, the storage engine works with foreign keys (Cabral K. S. , Murphy K., 2009).

I chose to study MyISAM and InnoDB storage engines because these are the most used engines in real implementations of distributed databases.

2.1. Comparison between MyISAM and InnoDB storage engines

The InnoDB storage engine recovers data by running log files.

MyISAM must completely scan all indexes and partially changed tables (Cabral K. S. , Murphy K., 2009).

InnoDB allows working with transactions (commit and rollback operations that modify the innodb_flush_log_at_trx_commit parameter).

MyISAM should run on the ext4 file system in order to be as good in terms of fault tolerance as InnoDB (Harrison G., Feurestein S., 2006).

InnoDB tables can be put on a highly efficient systems but we will see that because of concurrency control we can expect slow writing operations in DCM structures. InnoDB will store the lines in the order of primary keys.

MyISAM stores the lines in the order of their insert operations.

InnoDB provides storage of changeable compressed pages with the Lempel-Ziv-Welch method.

Compressed MyISAM tables can not be modified. MyISAM uses table-locking mechanisms for inserts and InnoDB line-locking mechanisms. As will be seen in experiments, the present advantages of InnoDB will not be very useful in the DCM architectures.

Because the InnoDB storage engine is fully transactional (Forta B., 2004; Beaulieu A., 2009), DCM architectures that will work with such a storage engine will be influenced by available transactional isolation levels (repeatable reads - RR, Serializable - SE). The Read Uncommitted and Read Committed isolation levels and are not supported in a replication topology (Kruckenberg M., Pipes J., 2005; Pachev S., 2007; Davies A., 2010).

2.1. Experimental results for the MyISAM storage engine

The performance tests are made for 1000 insert operations in the same table (this is the table from the master system where all the slave machines are performing writing operations). Each slave system will make 1000 inserts in the table from the master server and I will take into account the replication types available in MySql(Statement based replication and Row based replication).

The interval dt is the time needed to perform the insert operations.

In the presented figures I worked with average values of three measurements.

For Statement based replication using the MyISAM storage engine I obtained the following average measurements for each group of slave systems(1, 2, 4, 6):

M_statement=[19802, 36239.5, 78629.91, 124728.444]

Table 1. **Experimental results for the MyISAM storage engine using the Statement based replication**

Repl.	Statement based replication											
Mes./No	1	2		4				6				
M1 – dt [ms]	21531	33594	33609	77656	77703	77672	77688	123641	123625	123672	123688	123672	123625
M2 – dt [ms]	18922	37094	37109	75125	75110	75094	75141	128329	128312	128875	128922	128360	128281
M3 – dt[ms]	18953	38000	38031	83281	83250	83282	83313	121969	122015	122063	122016	122047	122000
M(AVG)	19802	36229.3	36249.6	78687.3	78687.6	78682.6	78714	124646.3	124650.6	124870	124875.3	124693	124635.3

For the Row based replication using the MyISAM storage engine I obtained the following average measurements for each group of slave systems(1, 2, 4, 6):

M_row=[21833, 41656, 78303.41, 132752.667]

Table 2. Experimental results for the MyISAM storage engine using the Row based replication

Repl.	Row based replication													
Mes./No	1	2		4				6						
M1 – dt [ms]	22125	38546	38547	72563	72531	72563	72516	131297	131375	131313	131328	131375	131344
M2 – dt [ms]	21765	42984	42969	88281	88359	88297	88328	138031	138110	138047	138110	138078	138078
M3 – dt[ms]	21609	43453	43437	74031	74062	74047	74063	128984	128969	129015	128031	129047	129016
M(AVG)	21833	41661	41651	78291.6	78317.3	78302.3	78302.3	132770.6	132818	132791.6	132489.6	132833.3	132812.6

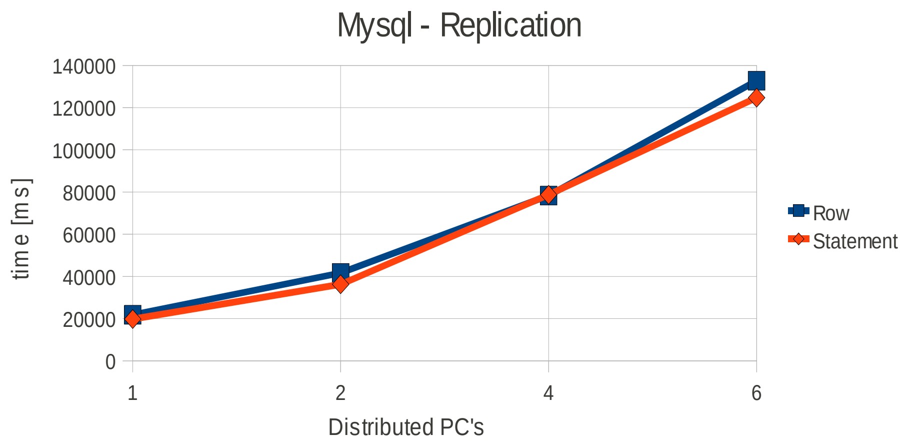

Figure 2. **Execution performance for 1000 inserts from each distributed slave system for the MyISASM storage engine.**

As we cand see in Figure 2, the results are slightly better for the Statement based replication. This is a normal result because in this case, MySql writes in the log file only the insert commands from each distributed station. In Row based replication we will have the actual data written in the log file.

The result table from the master server has the following dimensions on the disk: 1000 lines - 70 KB, 2000 lines - 140KB, 4000 lines - 281 KB, 6000 lines - 421 KB.

2.1. Experimental results for the InnoDB storage engine

In the tests for the InnoDB storage engine I will also take in consideration the transactional isolation levels(RR and SE) besides replication types.

Because the experimental data is to large to be posted in paper I will present the final results.

I obtained two average results(RR and SE) for the Statement based replication(the measurements were done just like in the previous case for 1, 2, 4 and 6 distributed slaves - each one makes 1000 insert operations in the result table on the master server):

M_statement_RR=[57604, 118776, 243393.33, 363315.22], for Repeatable Read isolation level.

M_statement_SE=[58901, 121502.33, 248732.58, 372607], for Serializable isolation level.

I also obtained two average results(RR and SE) for the Row based replication(the measurements were done just like in the previous case for 1, 2, 4 and 6 distributed slaves - each one makes 1000 insert operations in the result table on the master server):

M_row_RR=[55025.67, 118971.5, 243294.33, 361387.77], for Repeatable Read isolation level.

M_row_SE=[57755, 121187.5, 262196.75, 378583.22], for Serializable isolation level.

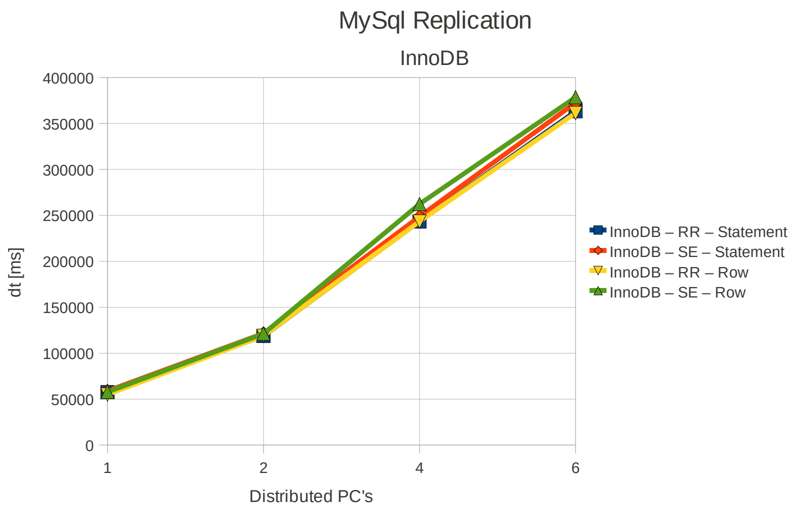

Figure 3. **Execution performance for 1000 inserts from each distributed slave system for the InnoDB storage engine.**

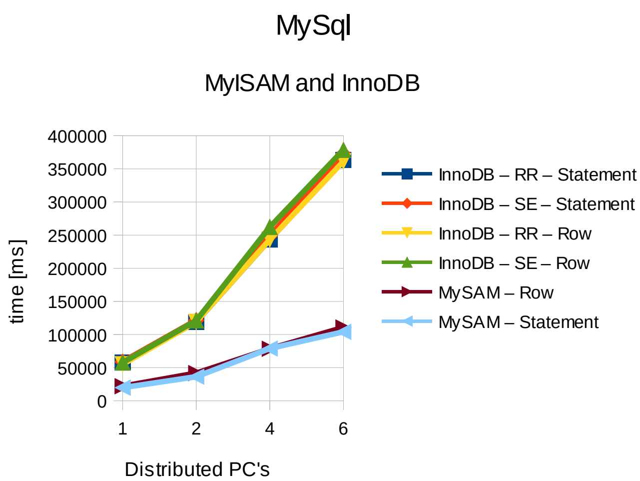

Figure 4. **Execution performance for 1000 inserts from each distributed slave system for MyISAM and InnoDB storage engines**

It is obvious that for DCM architectures the MyISAM storage engine is more suitable than the InnoDB storage engine.

3 Conclusions

The experiments show that it is advisable to use the MyISAM storage engine in DCM structures because the performances are much better (Figure 4). For 6 distributed systems I had 124 seconds for the MyISAM engine and 372 seconds for the InnoDB engine - 3 times more.

If we want to have optimization we can keep the input data of the DCM in tables that are using InnoDB storage engines and keep the result table from the combiner on the MyISAM engine. InnoDB is indicated if we want to have good data recovery possibilities and if the input tables are in relation with other tables through foreign keys. Further, we can minimize as much as possible the writing operations of the slave systems on the master server.

We can see from the experiments that even if the MyISAM engine uses table-locking mechanisms for controlling concurrency we still obtained very good results. The InnoDB engine should be better only if we will increase heavily the number of distributed systems in the DCM structure.

Another important conclusion is that we must choose careful the type of replication(Statement based replication is more suitable in DCM structures than Row based replication) and transactional isolation level (in case we work with the InnoDB engine).

In real world implementations we can see that even if we have a very fast Data Mining algorithm the overall execution time will be very bad because of design flaws(ex. choosing the wrong storage engine). Data compression can also affect the performance of a DM task. Further studies must be made in order to see if other algorithms can be used in database storage engines(Rădescu, R. 2010; Rădescu, R. 2010).

This study is useful for fields like machine learning, distributed learning(Rădescu, R., Birkan, I., 2015; Rădescu, R., Soare, B., 2014; Rădescu, R., Davidescu, A., 2010), adaptive learning, biology, astronomy, medical research, medical diagnosis, gaming, management, financial research.

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Optimization for Distributed Committee Machines in The Knowledge Discovery in Distributed Databases Process

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Abstract

The knowledge discovery in distributed databases represents the overall process of obtaining useful information from data that is stored in a replication topology on multiple computing systems. Distributed committee machines are formed by many neural networks that work in a distributed manner on multiple computing systems for resolving one data mining task. These architectures are the most suitable neural structures for working in a replication topology. In my case I used multilayer perceptrons trained with the backpropagation algorithm for resolving the classification task. In this paper I propose an optimized way of functioning for the entire distributed committee machine architecture by choosing the appropriate database engine, the best type of replication and by reducing the writing operations into the distributed database as much as possible. All the experiments were done on large data sets in order to achieve the best results. This study is useful in research areas such as distributed learning, adaptive eLearning, machine learning, medical diagnosis, astronomy and many others.

Keywords: Knowledge Discovery in Distributed Databases, Data Mining, Distributed Learning

1 Introduction

"Knowledge Discovery in Databases (KDD) is the non-trivial process of identifying valid, novel, potentially useful, and ultimately understandable patterns in data" (Fayadd, U., et al, 1996). It consists of the following steps: selection of target data, preprocessing of the raw data, transformation of data, data mining and the interpretation(evaluation) of the obtained results (Fayadd, U., et al, 1996). If the obtained results are not useful, the whole process must be repeated.

One of the most important phase in the entire KDD process is the Data Mining(DM) step. Usually DM tasks are: classification, regression, clustering, summarization, dependency modeling, change and deviation detection.

Knowledge Discovery in Distributed Databases(KDDD) is finding useful information in distributed databases. If data is distributed across multiple computing machines, is important to have a DM architecture that suits well for working in such a manner. Based on my research I chose to work with Distributed Committee Machines(DCM) for resolving the classification task.

2. Distributed Committee Machines

The Distributed Committee Machine architectures consists of many neural networks(I used multilayer perceptrons) that work in a distributed manner in order to achieve better results than only one neural structure.

In previous work I proposed an optimized design of a real implementation of DCM architecture that is working with distributed databases(Pupezescu V., 2015):

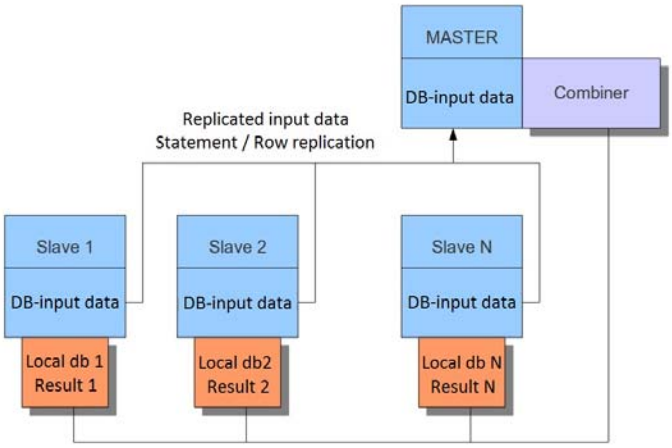

Figure 1. **Optimized DCM architecture (Pupezescu V., 2015)**

I discovered that a DCM implementation that uses a real distributed database(MySql) works very slow if neural networks are writing on the master server in the table results. If the table results is replicated on all distributed systems we will obtain distributed accelerations that are almost zero(Pupezescu V., 2015). In this design I proposed that just input data to be replicated on all distributed systems(in this way we will have the same input data for all the neural networks). Each distributed result is written locally. In the end, the combiner will pick or combine the individual results from each distributed slave. Another optimization was the storing of the neural networks as BLOB(Binary Large Objects). In this way I have the advantage of keeping the whole neural structures as Java object in database so it will not be necessary to memorize all the weights in separate files.

I created the result table on the combiner with the following structure:

Result(id, PCICtest, Pi, Po, ip, problem).

I used the following data types for the attributes: id - BIGINT(20) (this field is the PRIMARY KEY for the table), PCICtest - DOUBLE (or PCICg - this field represents the percentage of incorrect classifications in tests - how many input data from the test set are incorrect classified), Pi - BLOB (this is the entire multilayer perceptron stored as Java object - this is the initial state of the multilayer perceptron), Po - BLOB (this is the optimum state of the same multilayer perceptron that was trained - in this form it obtained the best classification results), problem - VARCHAR(10)(this is the classification problem).

The number of writing operations will be reduced as much as possible by making the inserts into the result table only when we have a better classification result (a lower PCICtest). This is the main optimization that was made in this case.

$$TR=\{\underbrace{(\overline{x},d)_{1,}\dots}_{trs}\overbrace{(\overline{x},d)_{tr}}^{trr}\};$$

$$TS=\{\underbrace{(\overline{x},d)_{1,}\dots}_{tss}\overbrace{(\overline{x},d)_{ts}}^{tsr}\};$$

Figure 2. **Training and testing data**

In my experiments I chose the "winner takes it all" policy for the combiner. Other combiner policies can be used also: ensemble averaging, boosting or mixture of experts.

The multilayer perceptron (MLP) was trained with the backpropagation algorithm.

The training(TR)and testing data(TS) was arranged as follows:

The classification problems that were analyzed are the satlog data set (classifying the type of terrain of an satellite image) and the heart data set (detection of a heart disease based on a number of input attributes):

Table 1. **Satlog data set**

satlog	trr	tsr	trs	tss
Lines	3217	3218	3217	3218
Columns	6	6	36	36

Table 2. **Heart data set**

heart	trr	tsr	trs	tss
Lines	460	460	460	460
Columns	1	1	35	35

I also analyzed how performance is affected by the database storage engines that were used: MySql - MyISAM and InnoDB. Another subject to discuss based on the experiments is the type of replication that I had in the experiments: Statement based replication or Row based replication(Schwartz B., et al, 2008).

The benefit of working with more than one neural networks in terms of execution times is shown with the Td parameter which represents the most detrimental case (it will take the value of the execution of the slowest distributed system). I measured also the sequential run of the same neural networks: Ts. Based on those parameters I calculated the distributed speedup S.

[1] $S_d = \frac{T_s}{T_d}$,

[2] $T_d = max\{t_1, t_2, ..., t_n\}$.

For all the experiments I had five distributed system: four of them(P1, P2, P3, P4) were used to achieve the classification DM task and the last one was used as a combiner.

The first experiment was to see what execution performance I had for 4 neural network that work in a sequential way(the slowest system from the structure) for the two classification problems. MySql was on default settings(Figure 3, Figure 4).The DCM structure was not optimized in any way (all tables were replicated on all the systems - including the results one).

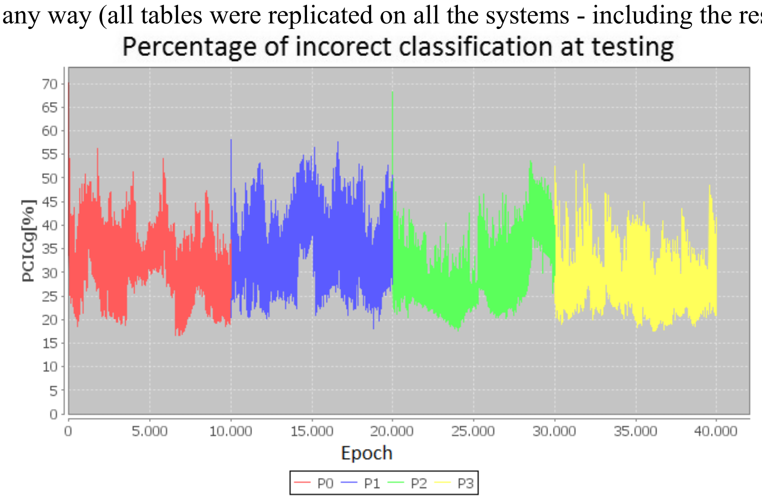

Figure 3. **Sequential execution for the satlog classification problem**

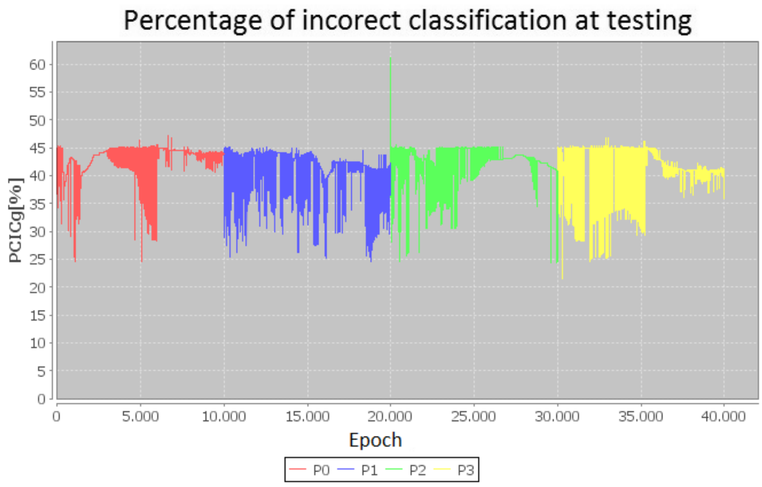

Figure 4. **Sequential execution for the heart classification problem**

Each multilayer perceptron run 10000 training epochs therefore I had 40000 training epochs for all neural networks.

The sequential performances are:

Satlog classification problem: Ts = 25962578 ms (approx. 7 hours and 20 minutes).

Heart classification problem: Ts = 2773938 ms (approx. 46 minutes)

We can see that the analyzed problems had bad performances in the sequential run.

3 Distributed execution with the MyISAM storage engine

The distributed execution on four distributed systems is presented in Figure 5 and Figure 6.

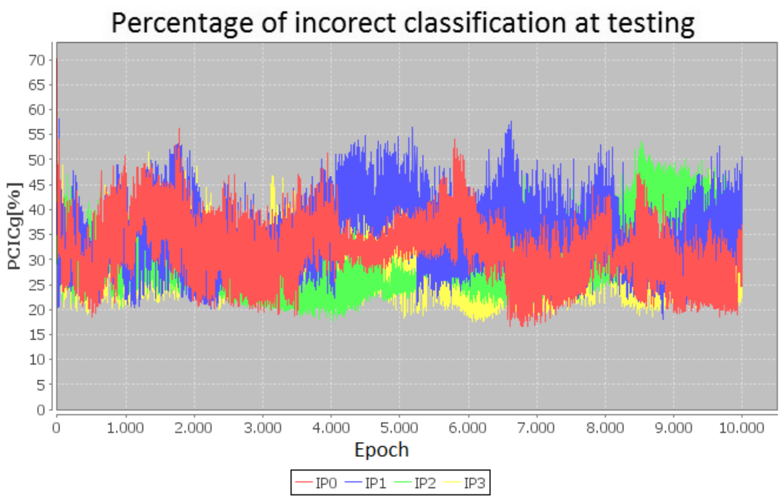

Figure 5. **Distributed execution for the satlog classification problem**

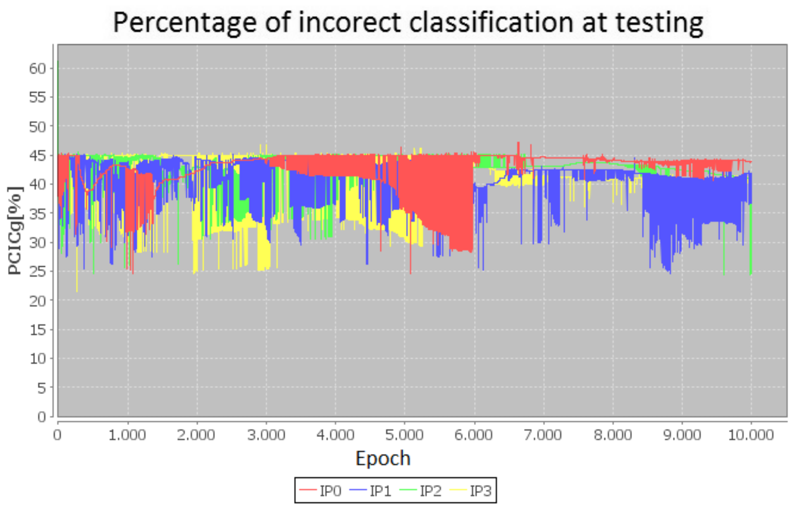

Figure 6. **Distributed execution for the heart classification problem**

All four distributed systems run 10000 training epochs in the same time. After every training epoch all MLPs run a testing epoch to initialize the PCICtest(or PCICg) value. The DCM structure was not optimized in any way regarding the design (all the insert operation are made on the server system and than replicated on all slave systems). The only optimization was to minimize the writing operation by setting the system to write in the distributed database only if we have a better classification result (PCICtest).

The performance of distributed execution for the Statement based replication is:

Table 3. **Distributed performance - Statement replication**

Satlog - 36 neurons on the hidden layer				Heart - 35 neurons on the hidden layer			
T1 [ms]	T2 [ms]	T3 [ms]	T4 [ms]	T1 [ms]	T2 [ms]	T3 [ms]	T4 [ms]
6527375	6497015	6316875	6321515	691860	694546	658969	657890

Satlog classification problem performance:
Distributed time Td = T1 = 6527375 ms (approx. 108 minutes).
Distributed speedup S = 3.97.
Heart classification problem performance:
Distributed time Td = T2 = 694546 ms (approx. 11 minutes).
Distributed speedup S = 3.99.
The performance of distributed execution for the Statement based replication is:

Table 4. **Distributed performance - Row replication**

Satlog - 36 neurons on the hidden layer				Heart - 35 neurons on the hidden layer			
T1 [ms]	T2 [ms]	T3 [ms]	T4 [ms]	T1 [ms]	T2 [ms]	T3 [ms]	T4 [ms]
6654281	6631109	6345422	6347172	710781	712735	661391	662063

Satlog classification problem performance:
Distributed time Td = T1 = 6654281 ms (approx. 108 minutes).
Distributed speedup S = 3.90.

Heart classification problem performance:
Distributed time Td = T2 = 712735 ms (approx. 11 minutes).
Distributed speedup S = 3.89.
When I used the optimized version of the DCM (Figure 1) I obtained the following results:

Table 5. **Distributed performance for the optimized DCM architecture - MyISAM storage engine**

Satlog - 36 neurons on the hidden layer				Heart - 35 neurons on the hidden layer			
T1 [ms]	T2 [ms]	T3 [ms]	T4 [ms]	T1 [ms]	T2 [ms]	T3 [ms]	T4 [ms]
6315484	6409000	6232532	6235703	679078	689656	660485	654672

Satlog classification problem performance:
Distributed time Td = T2 = 6409000 ms.
Distributed speedup S = 4.
Heart classification problem performance:
Distributed time Td = T2 = 689656 ms.
Distributed speedup S = 4.
In the experimental test I counted for each perceptron (P1, P2, P3, P4) the number of operations for updating the data in the database:
P1 has conducted 16 operations update data.
P2 has conducted 15 operations update data.
P3 has conducted 23 operations update data.
P4 conducted eight operations update data.

4 Distributed execution with the InnoDB storage engine

Bellow I will present the final experimental results in case that we are using the InnoDB storage engine for the result table. The charts for these executions are the same as Figure 5 and Figure 6.

Table 6. **Distributed performance for the optimized DCM architecture**

Satlog - 36 neurons on the hidden layer				Heart - 35 neurons on the hidden layer			
T1 [ms]	T2 [ms]	T3 [ms]	T4 [ms]	T1 [ms]	T2 [ms]	T3 [ms]	T4 [ms]
6616953	6576406	6303297	6344496	699547	696875	657797	656734

Distributed time Td = T1 = 6616953 ms.
Distributed speedup S = 3.95.
Heart classification problem performance:
Distributed time Td = T1 = 699547 ms .
Distributed speedup S = 4.
The best classification results are: PCICtest = 16.59% for the satlog problem and PCICtest = 21.5% for the heart problem.
One important observation is that if we use more distributed neural network, we will have more diversity and the classification results should be better.

5 Conclusions

With these experiments I proved that it is very important to know how to design a DCM architecture for real implementations. A sequential execution of the backpropagation algorithm for a multitude of neural networks is time consuming(for the satlog classification problem it took 7 hours and 20 minutes to finish the training and testing process).

The distributed execution is much better than the sequential one(I obtained distributed speedup values very close to the number of distributed systems that I had - 4) and that the final result depends on the slowest system from the whole architecture.

I also showed that if we still want to have all the advantages of distributed databases and the best recovery mechanism of data we can still use the InnoDB storage engine from MySql with the condition of minimizing the number of the insert operations on the system that contains the combiner (the master server). In cases where many writings operations will take place is better to work with the optimized version of DCM., with the MyISAM storage engine because InnoDB uses compression of data(Rădescu, R., 2010; Rădescu, R., 2010), it has time consuming concurrency control and recovery methods for data(Schwartz B., et al, 2008).

In this paper I showed also that even the type of replication can affect the overall experiment. From the experimental results I can say that for this kind of application, the Statement based replication(Schwartz B., et al, 2008) is indicated to work with.

We can see that the study of interactions between the KDD process and real implementations of distributed databases can bring many improvements in designing DM structures.

This research is beneficial for fields like machine learning, distributed learning(Rădescu, R., Birkan, I., 2015; Rădescu, R., Soare, B., 2014; Rădescu, R., Davidescu, A., 2010), adaptive learning, biology, astronomy, medical research, financial research, medical diagnosis, gaming, management.

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Augmented Reality System for Training Robotic Prostate Biopsy Needle Guidance

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Abstract

In this paper is presented an Augmented Reality (AR) system used for training the urologist to insert the biopsy needle using a serial robot as a case study. The AR based training set-up consists of a large screen projection system for the visualisation of the colocated environment and the software that uses one static single-camera marker tracking to colocate the virtual patient in the robot workspace and to provide guidance instructions for the urologist to perform the biopsy needle steering. The presented AR system has the potential to become a valuable education and training tool for users, helping them to acquire robotic operation skills that can be applied to robotic-assisted needle biopsy of the prostate.

Keywords: Augmented Reality, Surgery Robot, Biopsy, Robot Training

1 Introduction

A biopsy is a procedure performed to acquire a piece of tissue from a body which will be analyzed in laboratory to determine if cancer is present. During the past decade, different types of biopsy needle guiding robots where developed (Pisla et al., 2016; Plitea et al, 2015) for minimizing the risks and improving the precision of the biopsy procedure.

Surgical robots designed for biopsy procedures require pre-operative planning of trajectories prior to be used for needle guiding procedures and the urologist needs to acquire the necessary skills in order operate the robot. These skills can not be learned directly on patients.

There are few commercially available phantoms suitable for percutaneous biopsy, but their costs is high (Sekhar et al, 2014). In order to overcome this limitation, 3D simulation training can be used (Selmi et al, 2013; Villard et al, 2014; Tsuda et al, 2009). This method uses a 3D simulation of the robot environment and surgery environment and it allows to improve the familiarization with hardware equipment and to learn safe and effective techniques (Voros et al., 2013; Kwon et al, 2013; Rogula et al, 2013). 3D simulation training using virtual environments is an efficient learning method (Keshtgar et al, 2005), however require the necessity to prior reconstruct the detailed 3D virtual environments of the real environments.

The term "Augmented Reality"(AR) implies a variety of Virtual Reality (VR). In a VR system the user is completely immersed in the environment generated by the computer. An AR system will allow the user to visualize the real world, supplemented with computer-generated virtual objects coexisting with the real environment (Azuma, 1997). The main features of an AR system are: co-location of virtual objects in the real world; running interactively in real time; aligning real and virtual objects to each other. Therefore AR systems will not replace the real environment, but will add new information in order to assist the user in various applications. If the goal of VR systems is a total immersion in the virtual environment, the AR requires maintaining contact with the real world, virtual images being added over real ones. The advantage of such a system is that it will not replace the real world with a computer generated environment, but will add new information in order to help the user, offering the ability of manipulating both real and virtual objects. AR technologies are applied in many different fields including: medicine (Chen et al, 2015), manufacturing, military, education and entertainment etc. One of the main areas in which the AR technology is applied is robotics. The main advantage in using AR against VR is removing the need to generate a 3D virtual environment that represents the workspace. Therefore, the user interacts in a natural and intuitive way with the robot situated in an authentic 3D space.

This paper present ongoing research carried out at Transilvania University of Brasov with the aim to develop an operator interface based on AR technology that enables training of robotic prostate biopsy procedure. The prototype application presented allows to control a test case serial robot using a teach pendant and simulate the robot needle guidance biopsy actions on a 3D virtual patient co-located in the real working environment.

2 Materials and methods

2.1 The hardware architecture of the AR robotic biopsy training system

The AR robotic biopsy training system was developed based on serial robot (Kinova JACO), a high-performance graphical workstation (HP), a web camera (Logitech C300), a professional video projector and frontal large projection screen (presented in Fig. 1).

For the training of the robotic biopsy procedure a serial Kinova JACO robot (www.kinovarobotics.com) was proposed to be used as case study (Fig. 1). The robot arm has six degrees of freedom and is equipped with a three fingers based gripper that can be controlled individually. The gripper fingers can grasp easily various types of the biopsy guns.

In order to colocate 3D virtual models with real images and present them to the user is used a physical display device. Many types of AR display are available: Head Mounted Displays (HMD), portable displays (like Tabled PC), monitors and projectors. HMD is a common choice for AR because enhance the immersion sensation. If a HMD device will be used for the proposed AR system, the position and orientation of the calibrated 3D virtual model will change with corresponds to the movement of user. Because of this issue, for the presented system it was used an AR large screen projection system with one static single-camera. Acording to (Fiorentino et al, 2014) large screen projection technology can be a valid alternative to other types of AR displays.

The video projector (Digital Projection Titan 1080p Dual 3D Projector) has high definition resolution 1920x1080 for performant visual rendering. The images are projected on a frontal screen with the dimension of 4000x1500 cm. A fixed position webcam featuring 1280x1024 resolution was used for the tracking of fiducially markers and grabbing video images from the real environment. The graphical workstation is equipped with 12GB RAM memory, a Intel(R) Core(TM) i7 at 3.47GHZ CPU and NVidia QuadroFX 6000 graphic card running on the Windows 7 operating system.

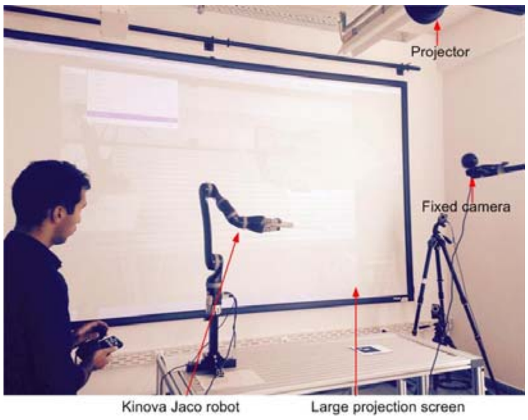

Fig. 1 **The hardware of the AR robotic biopsy training system**

2.2 The software framework of the AR robotic biopsy training system

The AR robotic biopsy training system was developed under the platform of the library called Instant Player (www.instantreality.org). The advantage of using this library is the possibility to integrate VRML graphical formats of virtual objects and possibility to create interactive AR environments using JavaScript and External Authoring Interfaces.

For the representation of the 3D models was used the Virtual Reality Modelling Language (VRML) ISO standard. Editing VRML virtual environment was realized through the application VRMLPad (www.parallelgraphics.com/products/vrmlpad/).

2.3 3D-reconstruction of virtual patient

The 3D model is obtained on the basis of the preoperative MRI data of a patient. The segmentation of the hard and soft tissue from MRI data was performed manually. For the 3D reconstruction from 2D slice images was used the 3D Slicer software (www.slicer.org). The resulted reconstructed 3D patient model was saved using the *.vtk format.

For the integration in the AR software framework, the model was converted in the VRML format separately for each anatomical entity as a set of IndexedFaceSet nodes composed by a number of vertexes and triangles. The conversion from the Slicer *.vtk 3D file format to the VRML type was done using the Paraview software. Then all the nodes where grouped in individual 3D surfaces with topological labels. Fig. 2 shows a patient with skin, bones, pelvis, bladder and prostate 3D models after the 3D-reconstruction.

Fig. 2 **The 3D reconstructed pelvis model of a patient**

2.4 Registration of the 3D virtual patient in the real environment

The InstantPlayer AR software allow identification of the square markers, determine 3D position and orientation of identified markers in order to align the virtual pacient onto the real one, register the 3D virtual pacient in the real environment.

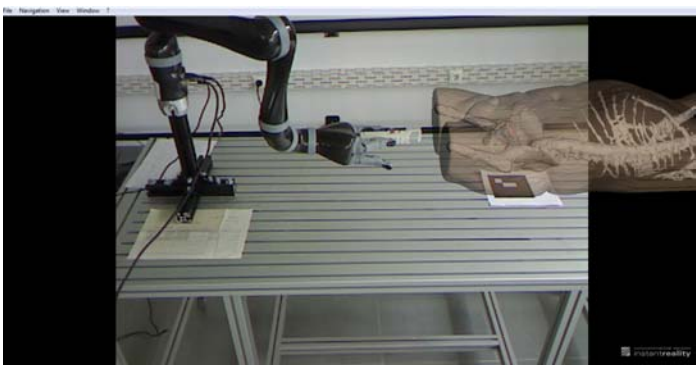

Fig. 3 **The establishment of 3D patient location in AR system**

In order to calibrate the virtual patient's position in relation to the robot using marker based tracking technology, the user has to carry out the following steps: (i) generate a reference marker using an using image editor (Fig. 3), (ii) add marker matrix data in the *.pm file of the Instant VisionLib module, (iii) integrate the tracker data from the *.pm as a reference file into the AR application and co-locate of the 3D virtual model on the real robot workspace by modification of scale, 3D position, and orientation, relative to the camera transformation matrix.

3 Test case

In the conducted test case, the users had to set configurations of the Jaco robot using the teaching pendant in order to allow positioning of the biopsy needle tip inside of the prostate quadrant and avoid the proximity with high risk organs (Fig. 4). The robot trajectories are recorded and saved using the JACO software. The users appreciate the possibility to learn robot needle guidance for transperineal biopsy procedure using as a test case a virtual patient and a real robot. However, they point out that improvements can be made on the graphics rendering and managing occlusions between real robot and virtual patient. Also the integration of a TRUS device simulation is needed.

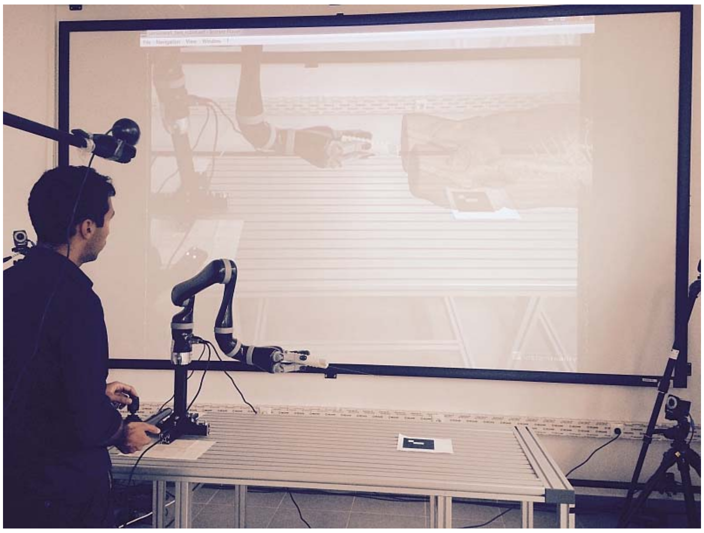

Fig. 4 **The simulation of robotic biopsy needle guidance using the AR system**

4 Conclusions

In this paper, it was presented a prototype AR system which has the potential for a promising tool for education and training of robotic biopsy needle guidance. It is based on the usage of augmented reality in order to introduce the virtual patient in a real environment. In this colocated environment the user can create and save robot trajectories, using reality based simulation directly available in the working environment. This approach helps inexperienced users to learn robot biopsy needle guidance in an intuitive way.

Acknowledgments

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A Virtual Laboratory for Teaching Internet of Things

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Abstract

This paper describes a virtual laboratory designed for teaching the course Internet of things. The goal was to create an environment that would support interactive learning and provide students with the necessary hardware and software for creating their own projects. The designed virtual laboratory was developed at the Department for e-business, Faculty of Organizational Sciences, University of Belgrade. As a proof of concept, we present a project for smart watering system implemented within our virtual laboratory.

Keywords: Virtual laboratory, Internet of things, smart environments.

1 Introduction

As technology develops, curricula of engineering courses evolve, and the infrastructure necessary for effective realizations of practical courses becomes more complex and expensive. Therefore, numerous courses turn to virtual laboratories, where hardware, software, and other necessary materials may be virtual or virtualized. Students have an opportunity to access those virtual laboratories through a Web based interface and conduct numerous experiments efficiently and at lower costs.

In this paper we have presented how a Web based virtual laboratory can be used in teaching the course Internet of things (hereinafter: IoT). The laboratory was designed as a platform that provides students with IoT devices and services. This platform was implemented at the Faculty of Organizational Sciences, University of Belgrade, where it is used for teaching IoT courses at the levels of undergraduate, master and PhD studies.

2 Literature review

Virtual laboratories have been recognized as efficient learning environment in numerous universities. They can be realized as simulations labs, remote labs or hybrid solutions (Balamuralithara and Woods, 2009). In the simulation approach the actual laboratory instrumentation and materials do not exist physically, but software provides student with virtual laboratory equipment. In the remote lab scenario, the equipment actually exists, and it can be remotely accessed over the Internet.

As the virtualization techniques develop, hybrid approaches also evolve. It becomes possible to virtualize the hardware and use it simultaneously in various multiple experiments. This approach enables emulation and realistic deployment environments. An example of this approach is the distributed virtual laboratory GENI (Global Environment for Networking Innovation). GENI combines heterogeneous virtualized resources to produce a platform for network experiments in network science, services, and security (Berman et al. 2014).

Virtual laboratories are widely used in science and engineering courses. Some of the examples include applications in teaching physics, chemistry, electronics, ICT and other disciplines (Ayas and Altas, 2015; Lu et al. 2015; Yalcin and Vatansever, 2015). As a relatively new ICT discipline, Internet of things is becoming an inevitable element of ICT curricula. Internet of things connects physical world with IT technologies and services, and enables various applications in business and life environments, such as smart homes, smart cars, smart cities, smart agriculture, smart grids and many others (Atzori et al. 2010; Chen and Hu, 2012; Silva et al. 2013).

An Internet of things course requires adequate hardware, software and network tools, where each student or a group of students should have their own equipment. The equipment for the course includes microcomputers, microcontrollers, sensors, actuators, mobile devices, etc. IoT technology enables identification, communication and interaction of these smart objects (Miorandi et al. 2012).

Pedagogical approaches in teaching IoT course almost always require practical activities, which allow students an opportunity to create their own dynamic learning experiences (Vilajosana et al. 2014). Some approaches are based on game based learning, where the goal is to learn through entertainment (Aziz et al. 2014).

Finally, virtual laboratories represent an integral part of education process an need to integrated with learning management systems, such as Moodle (de la Torre et al. 2015).

3 IoT virtual laboratory

The IoT virtual laboratory developed within this research is organized in two components: one for teachers, and one for students. Presently, teachers administer the laboratory completely, although these roles will be separated in the future.

When a student accesses the virtual laboratory, they can create projects of smart environments. They describe each project and provide the required documentation. They can also choose if the project is private or public. Private projects are available only to the team members and teachers. Public projects are available to all the users of the laboratory and the resources from these projects can be included in projects of other students. The shared projects can only be used for collecting data, while students' actuators are not allowed to be shared. On the other hand, teachers can add both sensor and actuator devices, and they can set if the devices can be activated by students or not. Each student has information if another student is using their devices within their projects, while teachers can monitor usage of all the devices in the laboratory.

After setting the project up, the students can add the components of the designed smart environment to the project. Students can include their own IoT hardware in the projects. They can add devices (microcomputers, microcontrollers, sensors, actuators) to the project, and provide the necessary metadata, such as title, description, location and IP address. Students can also select the devices provided through the platform by teachers or other students. Students can search by type of the necessary device, by keyword, etc.

When the device is selected and assigned to the project, the IoT platform generates an API key which can be used to access the device from Web and mobile applications that students are required to develop.

The teachers within the laboratory are provided with options to create projects and virtual devices and make them available to students. Teachers have insight into all the projects on the platform, and they are provided with rich reporting services.

Figure 1 shows the flow of the typical usage of the virtual laboratory, while figure 2 shows the screenshot of the home page of the developed laboratory, showing the list of the students' projects.

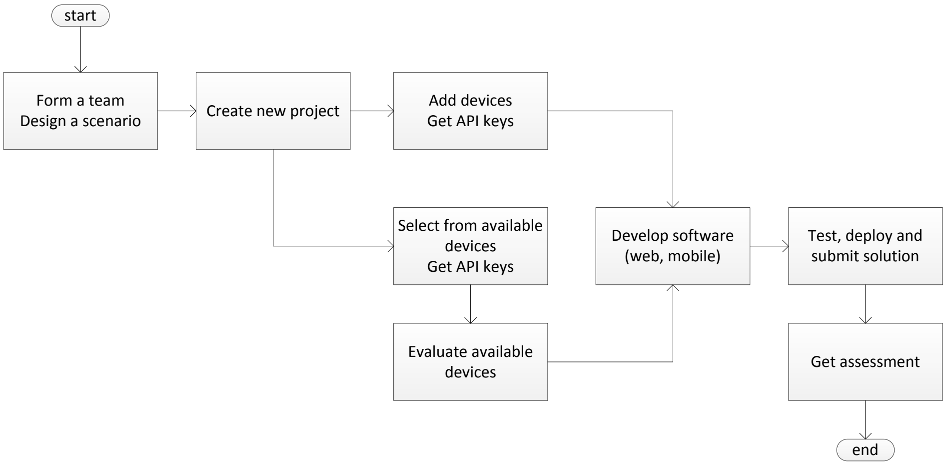


Figure 1. **A flowchart of typical usage of the designed virtual laboratory**

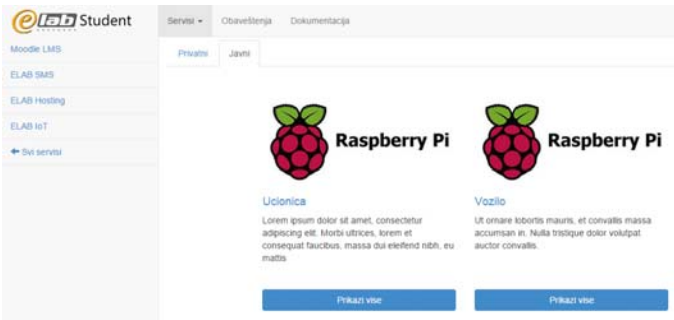


Figure 2. **A screenshot of the students' home page**

The developed laboratory was deployed within the cloud infrastructure and services of the Department for e-business, Faculty of Organizational Sciences, University of Serbia (Radenković et al. 2014). The platform is actively used for conducting the Internet of things courses (Bogdanović et al. 2014).

With respect to objectives described by Balamuralithara and Woods (2009), the designed laboratory conforms to the following objectives:

- Instrumentation: students are provided with sensors, actuators and other IoT equipment. Additionally, they can add their own equipment to their projects, and share the equipment with other students across the platform.
- Model and design: Students can create models of smart environments, and experiment with various equipment.
- Analysis: the platform provides possibilities of collecting data with basic visualisation options. However, for advanced analytics students are expected to use big data services.
- Creativity: students are assigned a task to design a smart environment and develop software that would include certain features. However, the design of the solution requires their creativity and independence in solving real life problems.
- Communication and teamwork: Students are expected to work in teams and use all possible means of communication. The preferred ways of communication are those integrated in learning management systems, such as forums, instant messaging, etc. Additionally, the platform supports sharing students' resources across the platform.

4 Proof of concept: a smart watering system

4.1 Project requirements and design

The assignment is to design and implement a smart watering system. The goal is to design and implement a system that uses the sensor data to automatically manage the watering system upon the set of user defined parameters. The solution should support the following functionalities:

- Sensor data should be gathered every minute and stored in a relational database.
- Watering is performed automatically at time defined by user.
- Watering is not performed if humidity or temperature are above the predefined levels specified by the user.
- Watering can be activated manually through a Web or mobile application.
- Users can set the system parameters through a Web application.
- Historical data is presented to users in a graphical form.
- Users should be alerted by email if humidity is lower than a predefined value, or if the temperature is higher than a predefined value. Also, users are alerted if the sensor is out of the function.
- Weather forecast should be acquired from an external Web based service.

The following equipment is provided to students:

- Sensors – temperature and humidity sensors are installed at Faculty's premises, connected to Raspberry Pi microcomputer and Arduino microcontroller. The sensor data can be accessed through API available to students within the IoT virtual laboratory.
- Actuators – a plant is connected to a smart watering system which consists of a watering pump connected to a power relay (actuator) that can be activated through API available within the designed virtual laboratory. Actuator is located at Faculty's premises.
- The virtual IoT laboratory described in the previous section. If a student wishes to connect their own sensors and actuators, they are able to do so. The project can also include sensors and actuators shared by other students through the virtual laboratory.

The design of the system is shown in the Figure 3.

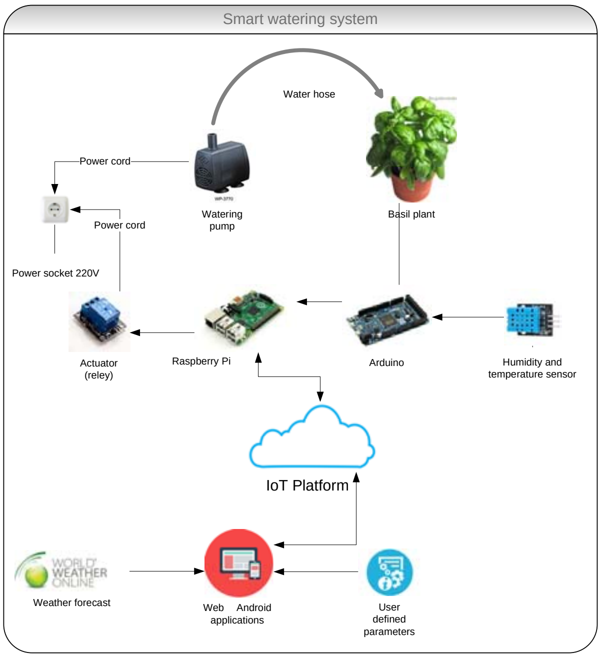


Figure 3. **The smart environment design**

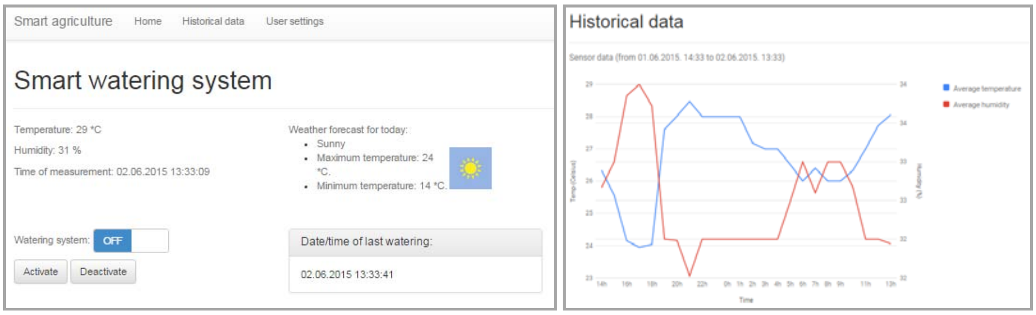
4.2 Solution

The developed solution includes the components described in the following text.

Database is implemented in MySQL. The database includes three tables: one for storing the sensor data, one for storing the watering data, and one for user settings.

A set of web services, where each web service provides a specific functionality: saving sensor data into the database, activation of watering system, deactivation of watering system, user alerting, and getting weather forecast information.

Developed Web application provides all the described features through a well-designed user interface. The application was developed in PHP programming language. Figure 4 shows two screenshots of the application. Figure 4a) shows the screen that shows the temperature and humidity, and provides options for remotely turning the watering system on and off. Figure 4b) shows the line chart of historical data for temperature and humidity for the last five days. Figure 5 shows the screen for defining user settings. Users can specify the time when the watering will be performed automatically by the system, the thresholds for temperature and humidity levels, and the parameters for alerts.



a) b)

Figure 4. **Developed web application**

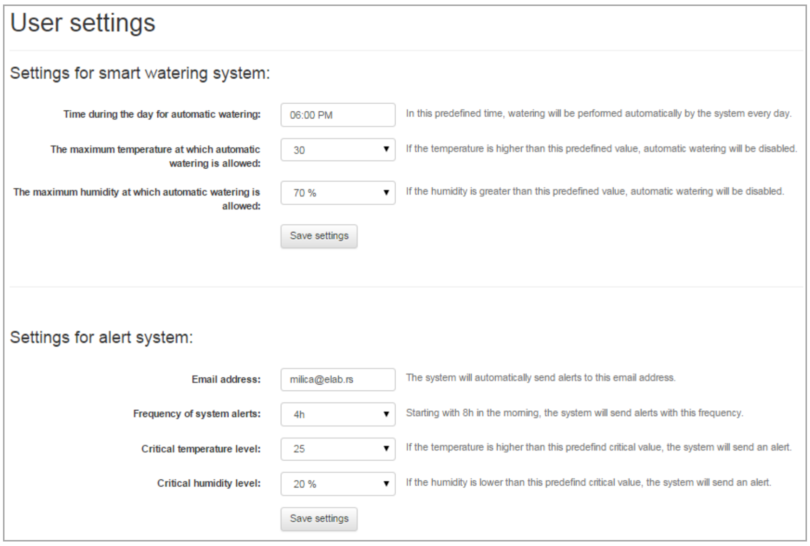


Figure 5. **Developed Web application – user settings**

The mobile application was designed for Android devices. The application includes fewer features than the Web application, but it offers the possibility to check the sensor data and to remotely activate and deactivate the watering system. Application screenshot is presented in the Figure 6.

5 Conclusion

In this paper the authors presented a virtual laboratory developed in order to support the Internet of things course. The virtual laboratory provides students with access to devices and features through platform as a service cloud computing model. The platform also supports adding of students' devices and sharing them among the students' projects.

Further work will be oriented towards developing new features and including additional IoT devices. Also, a comprehensive evaluation of students' knowledge and satisfaction in using this platform is yet to be performed.

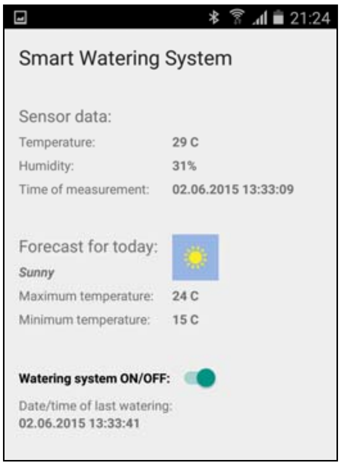


Figure 6. **Android application for smart watering**

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VRGIS Based Geography Enhanced Learning

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Abstract

This document A virtual reality geographic information system (VRGIS) based enhanced learning technology is proposed, which synthesizes several latest information technologies including virtual reality(VR), 3D geographical information system(GIS), 3D visualization and multimodal human-computer-interaction (HCI). The main functions of the proposed system are introduced, such as profile analysis, cutting analysis and iso-surface extraction. The multimodal technologies are employed in the system to enhance the immersive perception of the users.

Keywords: Virtual Reality, GIS, VRGIS, Geography Learning

1 Introduction

With the developments in web, mobile and virtual reality technologies as well as mass adoption of smart and mobile devices by all people in the current society, significant opportunities have emerged for e-learning applications [Lahti et al. 2012]. Location-based mobile phone software has been proved to have the potential in supporting biology, geography and math lessons for students in schools [Hansen et al. 2010]. The latest technologies from video game industry make it becomes easy and efficient to integrate the state-of-the-art graphics/interface and the educational aspect with poor graphics and interaction [Bellotti et al. 2009] [Mayo 2007]. The technologies of video games have attracted considerable attention to enhance user participation and motivation which should be a key concern in the design of an interactive human-computer-interaction(HCI) interface [Brinkman et al. 2008] of the learning enhanced system [Chen and Chen 2013]. Technology enhanced learning brings multidisciplinary, interdisciplinary, and pandisciplinary educational content in different forms [Boytchev et al. 2012] oriented to different culture [Vatrapu 2011]. The dynamic learning environments can deliver educational benefits as educational offerings based upon various characteristics of individual learners [Mulwa et al. 2010]. Synthesizing multimedia operations and knowledge sharing aspects has also attracted attention from the research community [Klamma et al. 2009]. The combinations of technology enhanced learning and other applied information field have been considered as promising practical research top-ics [Schmees 2006]. It has been argued that integration of concepts from GIS into Information Technology (IT) can provide impressive opportunities for education [Tomaszewski and Holden 2012]. The guidelines for the design of 3D virtual learning spaces has been suggested before [Minocha and Hardy 2011]. The related evaluation process has been proposed in previous research [Lahti et al. 2012] [Carroll and Rosson 2005]. Besides, a lot of other previous related researches have also inspired our research [Mustafa 2011] [Scanlon et al. 2015] [Underwood 2009] [Walczak et al. 2006] [Ng 2008] [Holzinger et al. 2009] [Chen 2006] [Paneva–Marinova et al. 2012] [Nagel et al. 2012] [Yannier et al. 2015].

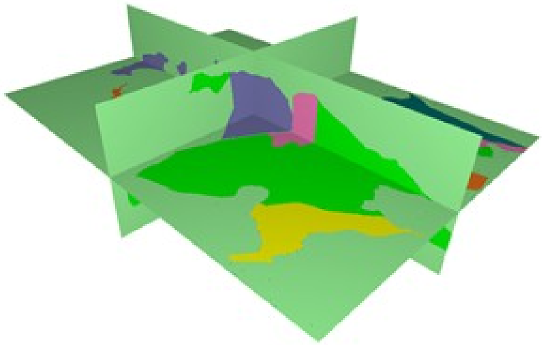

Figure 1. **Orthogonal Profile Analysis of Geologic Body**

In virtual reality technology trend, geospatial data visualization has never been developing rapidly [Rhyne and MacEachren 2004]. With the development of VR (Virtual Reality) technology and widely applications in various areas, the requirements to VR are also increasing rapidly. Virtual Reality Geographical Information System (VRGIS), a combination of geographic information system and virtual reality technology [Huang et al. 2001] has become a hot topic. Accordingly, '3-D modes' has been proved as a faster decision making tool with fewer errors [Porathe and Prison 2008]. Meanwhile, new user interfaces for geo-databases is also expected [Breunig and Zlatanova 2011]. With the popularity of network, the VRGIS platform based on the network environment also becomes a trend. The application of VRML, X3D and other online VR technologies have achieved networking of VR systems.

2 System Overview

In our system, three functions are developed as the enhanced learning tools, they are 'Profile Analysis of Sub-modules', 'Cutting Analysis of Sub-module for Geological Body', 'Iso-surface Extraction' and 'Iso-body Extraction'.

3 Functions

3.1 Profile Analysis of Sub-modules

Profile analysis (oblique, horizontal and vertical cut): profile analysis includes vertical profile analysis, horizontal profile analysis, and oblique profile analysis. Among them, vertical profile analysis cuts the model along the path of multi-stage line in the vertical direction, horizontal profile analysis cuts the model according to the horizontal cutting elevation set by the user, and oblique profile analysis arbitrarily cuts the model with the given parameter equation of oblique profile. The analysis results can be three-dimensional profile cutting body, profile cutting plane, profile cutting line and two-dimensional analysis of profile map.

Due to the spatial forms of geologic body models are complicated and change-able, in the cutting process, the segmentation and classification of the triangle isa complex process with high demand of computing. All floating-point variables in the module adopt the double precision, and implementation code must handle the round-off error of floating points. Flexibility: when designing the module, all operands adopt the data structure in the module to describe and realize the independence between operation and upper call system, which has a great flexibility in code reuse. Profile analysis is an interactive process of users and the system, and has the features of data complexity and computational complexity. The users focus on the validity and the visual expressing effect of the analysis result, so the demand for time is not very high.

The profile analysis and cutting analysis of geological body are similar to the principle of surface cutting body on the implementation of underlying algorithm, and the difference is that cutting analysis divides the space on the basis of surface object, and the profile analysis divides the space on the basis of body object. The basic idea is: Dividing the cutting object on the basis of the geological bodes spatial location, all the cutting objects and the triangle disjoint with the cutting objects are divided into internal and external parts, and the triangle spatially intersected with the cutting objects are resolved and distinguished at the intersection, then rebuilding the topology relations of internal and external triangle to form two objects (One object may not exist) after cutting.

The module adopts BSP tree to solve this problem, and the basic idea of BSP tree to divide the space is: any plane in the space can divide the space into two half spaces mutually disjointed, and the half space on the side of plane normal pointed is called the positive side of the plane, and the other side is called the negative side of the plane. If there is anther plane in any half space, it will further divide the half space into two smaller subspace. A polygon list can be used to proceed the process. When there is only a single plane in the space, it can construct a binary tree to describe the hierarchical structure of three-dimensional entity objects. Each node of the binary tree represents a partition plane. The left sub-tree of the node represents the positive side of the partition plane represented by the node, the right sub-tree of the node represents the negative side of the partition plane represented by the node, and the leaf node of the binary tree represents the convex region after the partition.

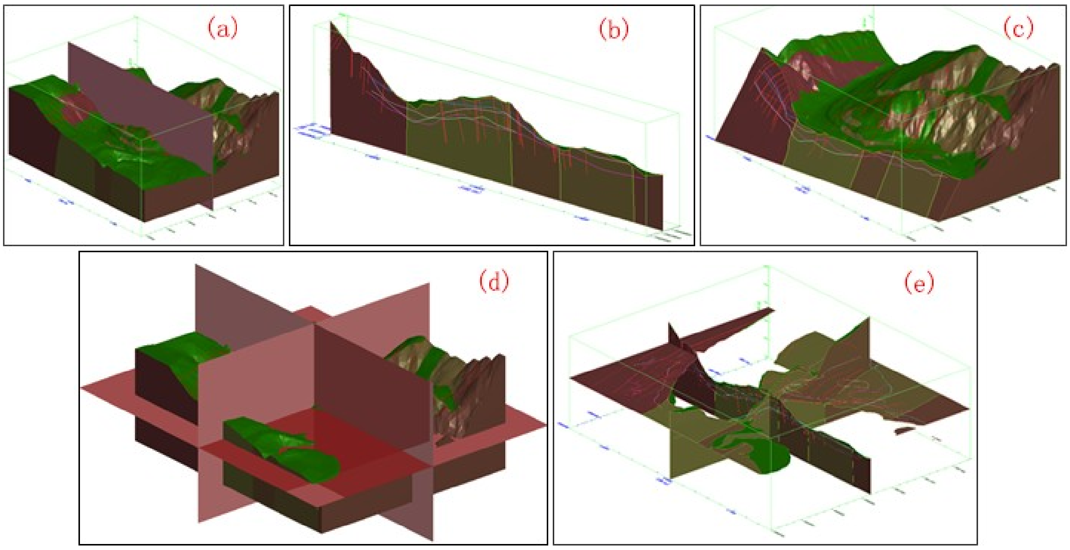

Figure 2. **System UI of Cross-section Analysis of Geologic Body. (a) Profile cutting operation; (b) Profile cutting line and profile cut- ting plane; (c) Profile cutting body; (d) Multiple cross-section orientation; (e) Profile cutting plane**

3.2 Cutting Analysis of Sub-module for Geological Body

The cutting analysis of geological body includes single cross-section analysis and multiple cross-section analysis. Single cross-section analysis refers that by setting the spatial orientation and position of the section, it cuts the three-dimensional geological model to get the profile cutting line, the profile cutting plane and the profile cutting body of the model, and to conduct the geological analysis. Single cross-section analysis can freely set the spatial orientation of the section, which can be operated flexibly through dragging and dropping the mouse, or through the functional interface setting, as shown in the figure below:

Multiple cross-section analysis is different from the single cross-section analysis, which only can show the analysis result in the form of profile cutting plane and profile cutting line, and the orientation of each section is fixed vertical X, Y and Z axis, as shown in the figure below.

Due to the spatial forms of geologic body models are complicated and change-able, in the cutting process, the segmentation and classification of the triangle is a complex process with high demand of computing. All floating-point variables in the module adopt the double precision, and implementation code must handle the round-off error of floating points. When designing the module, all operands adopt the data structure in the module to describe and realize the independence between operation and upper call system, which has a great flexibility in code reuse. Vector cutting analysis is an interactive process of users and the system, and has the features of data complexity and computational complexity. The users focus on the validity and the visual expressing effect of the analysis result, so the demand for time is not very high.

The basic idea of vector cutting is: Dividing the cutting object on the basis of the cutting objects spatial location, all the cutting objects and the triangle disjoint with the cutting objects are divided into internal and external parts, and the triangle spatially intersected with the cutting objects are resolved and distinguished at the intersection, then rebuilding the topology relations of internal and external triangle to form two objects (One object may not exist) after cutting. The key step of cutting algorithm is to judge the spatial relations of constraint surfaces such as the point in the space and the three-dimensional geo- logic body, and the topography and geologic boundary, etc. The module adopts BSP tree to solve this problem, and the basic idea of BSP tree to divide the space is: any plane in the space can divide the space into two half spaces mutually disjointed, and the half space on the side of plane normal pointed is called the positive side of the plane, and the other side is called the negative side of the plane. If there is an this plane in any half space, it will further divide the half space into two smaller sub-space. A polygon list can be used to proceeding the process. When there is only a single plane in the space, it can construct a binary tree to describe the hierarchical structure of three-dimensional entity objects. Each node of the binary tree represents a partition plane. The left sub-tree of the node represents the positive side of the partition plane represented by the node, the right sub-tree of the node represents the negative side of the partition plane represented by the node, and the leaf node of the binary tree represents the convex region after the partition.

3.3 Iso-surface Extraction

Iso-surface refers that in the spatial structure, it uses a set of curved graph (The iso-surface fitted by the curved surface) to represent those points with the same quantity value in a known quantity, so that to describe the distribution law of the quantities with continuous distribution characteristics, which is the continuation of contour map from two-dimensional graph to three-dimensional graph. In the analysis of spatial structure, the normal structural body is dispersed into the spatial grid assembly, and through numerical calculation, it can obtain some analyzing quantity values in the node of spatial grid. On the basis of these discrete and limited data, using the iso-surface method can obtain the iso-surface of a certain quantity value in the spatial structural body, and using the iso- surface method can be convenient to determine the sliding surface.

Iso-surface is the assembly of all points with the same value in the space, which can be represented as:

$(x, y, z)|s(x, y, z) = c$, where c is the constant

It is a cubic surface, and the iso-surface is made up of many iso-surfacepatches. The iso-surface refers that in the three-dimensional space, using surface fitting to form the points with the same quantity value and the same unit in the physical quantity of spatial distribution into a set of curved surface, sothat to describe the distribution laws of those physical quantity with continuous distribution characteristics.

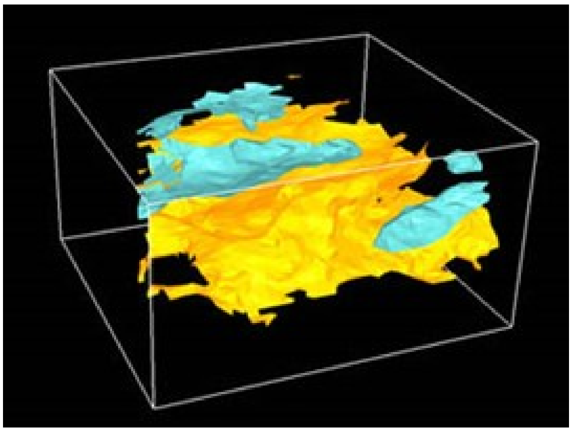

Figure 3. **Iso-body Extraction**

3.4 Iso-body Extraction

Inclosing the iso-surface with the same physical quantity to form an iso-body, and it is the continuation of the iso-surface. According to different purposes, it can extract different iso-bodies in the same area, and the extraction of the iso-body is the basis of the spatial object, which is normally used in the geological model. The equivalence of the iso-body is not only reflected in a plane, but also reflects the connection of equivalent points in every direction of the space.

Iso-body refers that in the three-dimensional space, fitting the points in the physical quantity of spatial distribution with the same quantity value and the same unit, but not in the same plane, to be a unit of iso-body, so that to combine into a global iso-body. In analyzing the geologic model, it often has different stratums. It is divided into upper and lower cubes to determine a quantity value, and the seeks the iso-point in the two layered cube to be fitted into the iso-surface respectively. A curved surface fitting is made in the stratigraphical boundary, and the interpolation forms an iso-body.

Figure 4. **VRGIS Running onVirtual RealityGlassess Device**

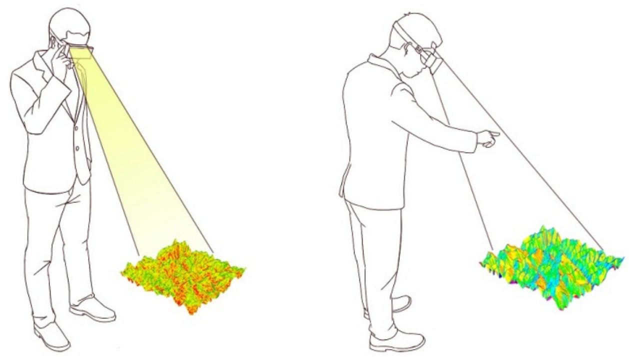

Figure 5. **Left: the user wears the virtual reality Glasses to look at the virtual 3D GIS; Right: the user wears the virtual reality Glasses and use touch-less interaction to manipulatethe 3D GIS**

4. Application

The oriented city region simulation Web VRGIS engine is developed based on OpenGL and C++, which integrates VR and GIS seamlessly and supports massive data.

As shown in the figure, the user is watching the virtual geographical scene through the HMD. The HMD is the VR glasses shell by which users could watch the anaglyph 3D scene generated from smart phone screen. The convergence-to-face part of the HMD for light blocking is made by soft holster filling of sponge, so it's not oppressive at all. In addition, it can modify the pupil distance (PD) and depth of field (DOF), so it is suitable for the users with different myopia degree and PD. The input methods include head motion and remote controller. The head motion on VR glasses only supports the rotations around three axis which are controlled by gyroscope sensor of the smart phone. The head rotation actions are synchronous with the rotation of the camera view in the VR scene, which brings the immersive perception to the user in real time. Meanwhile, the remote controller is used to input the displacement of the 3D scene as well as manipulate the menu of the software configuration.

5. Conclusion

Web VRGIS is used to show the geographical information intuitively as an enhanced learning tool. Geographical information has several characteristics, ie. large scale, diverse predictable and real-time, which falls in the range of definition of Big Data defined by Faye Briggs [4]. Virtual reality is a promising and suitable technology to represent geographical big data. In future, the new technology will enhance the learning process, for example, multiple users may support the teacher to train a class at the same time.

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Designing augmented reality application for interaction with smart environment

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Abstract

This paper discusses harnessing augmented reality for interaction with smart classrooms. Primary goal is to investigate possibilities of augmented reality applications within smart environments. Main characteristics and concepts related to augmented reality and smart environments were analyzed. As a proof of concept, an iOS mobile application was developed. The application is an editor for smart classrooms using augmented reality. Students and teachers are enabled to interact with smart classrooms via mobile devices. The smart classroom is implemented within learning ecosystem at Laboratory for E-business, University of Belgrade.

Keywords: augmented reality, mobile technologies, iOS, smart environments, smart classrooms.

1 Introduction

Nowadays mobile applications are very fast-growing industry and its use is diversiform. In the field of education, gaining and keeping students attention has been much of a challenge, especially in the last decade. Many changes were needed in order to successfully overcome this obstacle. One of which was use of modern gadgets and devices that are known as "smart" devices – computers, mobile devices and tablet, as well as whole "smart" environments such as smart classrooms. This paper will discuss possibilities of using modern technologies, especially Information Technologies for introducing improvements in the field of education, as well as increasing quality of teaching.

The paper implies using advantages of smart classroom and its interactivity for developing a mobile application that will communicate with this smart environment. Further, augmented reality concepts will be harnessed in order to display results of this interaction to end users. Next phase of development of the mobile app is to enable communication with smart environment in opposite direction, which will allow user to trigger an event in smart environment. By implementing these concepts and functionalities into a mobile application we are creating "Reality editor" application that allows users to change attributes or behavior of the environment and give feedback to the user about current state of the environment and values of its attributes.

Augmented reality technology has already proved to be useful in the fields of education. Basic example of this use is superimposing text, graphics, video and audio into a student's real time environment. Textbooks, flashcards and other educational reading material can contain embedded "markers" that, when scanned by an AR device, produce supplementary information to the student rendered in a multimedia format. It is proven that adding AR generated material into traditional teaching material has very positive impact on students. They tend to learn lessons in less time and with better understanding and also they get more interested in these subjects. Smart classrooms are, generally speaking, technology enhanced classrooms that foster opportunities for teaching and learning by integrating learning technology, such as computers, specialized software, audience response technology, assistive listening devices, networking, and audio/visual capabilities. Smart classroom that will interact with our mobile application is equipped with numerous sensors that detect and measure different attributes of the environment and describe state od the environment with this measures. Smart classrooms and AR concepts as well as their usage in educational purposes will be discussed in details in next chapter.

Main goal of this paper and development of "Reality editor" application is to bring innovations into educational system and explore possible practical uses of this application now and in the future. Another goal is to measure and analyze contribution to better learning and understanding of lessons by students expressed as level of effort put into mastering the subject and archived grade on final exam.

2 Augmented Reality and Smart Classrooms

Augmented reality (AR) is a live direct or indirect view of a physical, real-world environment whose elements are *augmented* (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data (Klette, 2014). Augmentation is conventionally in real-time and in semantic context with environmental elements, such as sports scores on TV during a match. With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulable (Martín-Gutiérrez et al., 2015). Artificial information about the environment and its objects can be overlaid on the real world. Numerous studies have discussed possibilities of using AR in learning environments (Fengfeng & Hsu, 2015) Our application will use these advanced techniques of scanning the environment and recognizing shapes and object that will trigger desired action.

Computer vision is a field that includes methods for acquiring, processing, analyzing, and understanding images and, in general, high-dimensional data from the real world in order to produce numerical or symbolic information (Morris, 2008) (Sonka, Hlavec & Boyle, 2004). Computer vision is complex concept and can do multiple tasks at once. Most important tasks that computer vision is able to do are (Morris, 2008):

- Recognition - image processing, and machine vision is that of determining whether or not the image data contains some specific object, feature, or activity
- Motion analysis
- Scene reconstruction
- Image restoration etc.

Object recognition is task within computer vision of finding and identifying objects in an image or video sequence (Ahmed, 2010). There are many methods and algorithms that are used to detect and recognized desired object. The best algorithms for such tasks are based on convolutional neural networks. Google Goggles or LikeThat are wide known example of gadgets that are based on this concept.

Smart Classroom concept is based on implementing and integrating advanced hardware and software technology solutions into traditional school classrooms. The goal is to improve and ease schooling. Solution like this allows performing the so-called interactive classes, using teaching materials in electronic forms (e-books, presentations, animations, movies etc.), monitoring activities of each student, collecting and analyzing data about activity and grades of each students, easier communication between students and teacher and many others.

Main components of smart classrooms are network and wireless infrastructure for connecting all separate components, smart whiteboard, tablets, laptops, software platform for smart classrooms and e-teaching material. Part of the solution is education and training of all teachers involved in activities and lessons in smart classroom.

In practice, there are many forms of smart classroom implementations e.g. classrooms based on video conference systems, remote education solutions based on multimedia environment that allow video communication, chat, etc.

Our "Reality Editor application" will be based on advanced Augmented Reality techniques that will allow us to detect and recognize various sensors implemented in smart classroom. Application will use third-part library that contains all logic and algorithms for object recognition. Our application will be working in real environment, i.e. smart classroom on Faculty of Organization Sciences at the University of Belgrade. This classroom has all smart devices that all smart classrooms have and additionally, it is equipped with several sensors that detect and measure temperature, humidity, movement, noise, light, smoke and CO_2 (Figure 1).

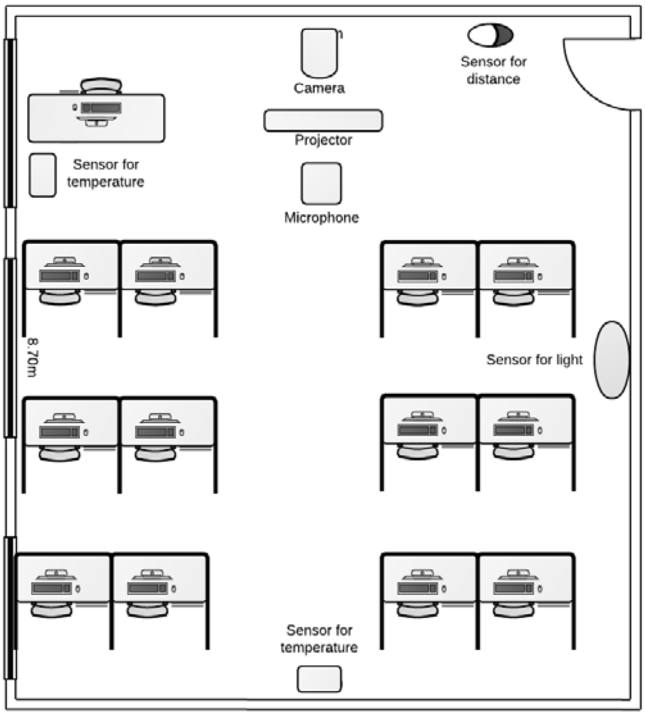

Figure 1. **Sensors inside Smart Classroom**

3 Solution as a proof of concept

"Reality Editor" is mobile application that is going to be used in smart classroom at University of Belgrade and so they need to be compatible in aspect of possibilities. For the first version of the application we wanted to be able to detect and read specific data provided by sensors in the classroom. Few possible solutions were taken into consideration at the beginning of planning of the project. There were two main alternatives for sensor searching - using QR Code scanner for searching each sensor's QR Code image and the other one was using Augmented Reality to find sensors in the room. Using QR Codes is simpler, but also has much more limitations. Using Augmented Reality offers much more possibilities for further upgrade and later can be used for new features that exclude existing of physical markers like QR Codes.

After deciding that our app needs to implement Augmented Reality features we analyzed SDKs on the market that can be used in these purposes. There are several big companies that offer

SDKs for Augmented Reality and the difference is in algorithms and logic they use in order to find the right match. The algorithm used has two characteristics – speed and accuracy. The fact is that if we want more speed, accuracy would be lower and opposite. The alternatives here were: Wikitude, Qualcomm Vuforia and Metaio. Metaio SDK doesn't offer best accuracy, but has excellent speed and is a bit simpler than other alternatives. Since the application will not use complex image recognition, this is satisfying choice.

Metaio SDK uses SURF algorithm in order to find desired object in the environment (Figure 2.) (Bhanu & Nuttall,2015). *Speeded Up Robust Features* **i**s a local feature detector and descriptor that can be used for tasks such as object recognition or registration or classification or 3D reconstruction. It is partly inspired by the scale-invariant feature transform (SIFT) descriptor. The standard version of SURF is several times faster than SIFT and claimed by its authors to be more robust against different image transformations than SIFT. SURF is a detector and a descriptor for points of interest in images where the image is transformed into coordinates, using the multi-resolution pyramid technique. Is to make a copy of the original image with Pyramidal Gaussian or Laplacian Pyramid shape and obtain image with the same size but with reduced bandwidth. Thus a special blurring effect on the original image, called Scale-Space is achieved. This technique ensures that the points of interest are scale invariant. The algorithm has three main parts: interest point detection, local neighborhood description and matching.

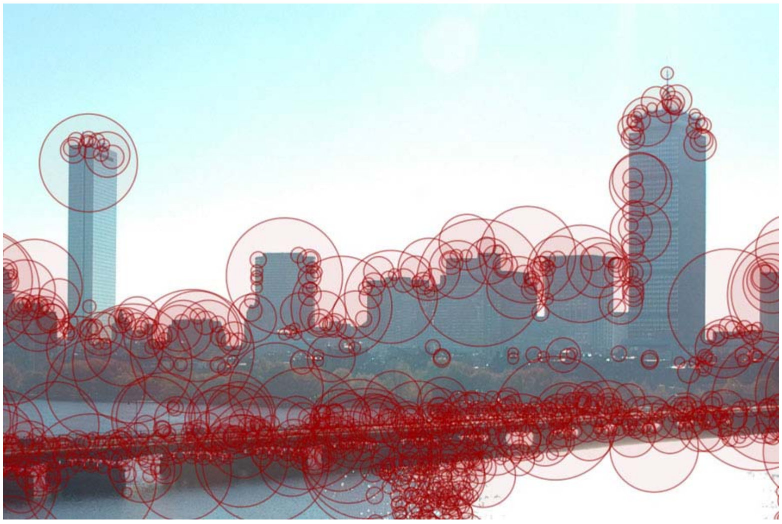

Figure 2. **SURF Algorithm Parts**

An interest point is a point in the image which in general can be characterized as follows:

- it has a clear, preferably mathematically well-founded, definition,
- it has a well-defined *position* in image space,
- the local image structure around the interest point is rich in terms of local *information contents* (e.g.: significant 2D texture), such that the use of interest points simplify further processing in the vision system,
- it is *stable* under local and global perturbations in the image domain as illumination/brightness variations, such that the interest points can be reliably computed with high degree of *reproducibility*.

- Optionally, the notion of interest point should include an attribute of *scale*, to make it possible to compute interest points from real-life images as well as under scale changes.

In SURF, square-shaped filters are used as an approximation of Gaussian smoothing.

Local neighborhood descriptor provides a unique and robust description of an image feature, e.g. by describing the intensity distribution of the pixels within the neighborhood of the point of interest. Most descriptors are computed thus in a local manner; hence, a description is obtained for every point of interest identified previously.

The dimensionality of the descriptor has direct impact on both its computational complexity and point-matching robustness/accuracy. A short descriptor may be more robust against appearance variations, but may not offer sufficient discrimination and thus give too many false positives. The first step consists of fixing a reproducible orientation based on information from a circular region around the interest point. Then we construct a square region aligned to the selected orientation and extract the SURF descriptor from it.

At the end by comparing the descriptors obtained from different images, matching pairs can be found. Metaio SDK takes an image of each frame from the camera and rescales it in 5 different levels – resolutions sorted from low resolution to high resolution. In each of these images Metaio tries to find the right matching by trying to wrap the target image into the frames taken based on interest points and their neighborhood. Besides adding Metaio SDK to the app, we need to provide assets that will be used for recognition. Metaio SDK can load MD2, OBJ and FBX models.

When an user makes view of the environment through the application an API request will be triggered. The request fetches the information of the sensor that will be displayed the screen. Figure 3 presents a view of the environment through mobile device with information about current temperature.

Figure 3. **Presentation of data from sensor parameters within mobile application**

The "Reality editor" enables users to edit some certain parts of the environment. For instance, the user can switch on/off the light by simple click on the screen.

4 Conclusion

Augmented Reality technology is very flexible and adaptable and can be used in many fields of work and aspects of life. Finding new use cases is almost unlimited and depends on creativity of the developer. Our idea is to take as many advantages of this technology as we can with goal to improve education and teaching quality in smart environment. The goal is to combine smart devices with modern technologies and offer students interactive classes that will guarantee their activity and involvement with subject of teaching. We have made first steps on this way by creating mobile app that can detect and read data given by sensors in smart classroom, and show them on the screen. In the future we will add new features to the app gradually. We will involve action sensor that exist in the classroom – turning lights on/off, turning A/C on/off and lowering and lifting of blinds. This way we will have communication with environment in both directions.

In almost every segment of industry and businesses smart devices take over the main role. They are used for performing all kinds of work, from simple ones to most complex ones. They are used for communication between people, other devices and computers, for managing, decision making, problem solving etc. These devices, along with technologies they support are becoming standard tool in the field of education.

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Model of determination of coverings with web pages for a website

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Abstract

In the majority of web sites there are web pages that are built similar. This paper uses a relation of similarity of HTML web pages for determining covering sets with web pages for web site that will be used in the verification and testing process. So these operations will use a smaller number of web pages.

Keywords: Web Application, Web Page, Algorithm, HTML Tag, Sets.

1 Introduction

The explosive development of web applications leads to the identification of some modalities of selecting certain components from within, which represents the best the modality of functioning.

For example, in processes of website comparison, an efficient way is almost impossible to be found when the number of files is big. By making a concession related to the accuracy of the comparison, different mechanisms can be found, which can lead to algorithms with a higher efficiency in terms of runtime and memory. From this point of view, we will present a modality of selecting certain web pages from a website.

Besides similarity, we can also use the identification of some web pages (called coverings with web pages for websites) in other operations such as complexity measure, testing, verification.

In section II we will present a modality of grouping web pages from a website depending on similarity. For this thing we will use results obtained in various articles.

In section III an example for every notion from section II is presented.

Section IV presents the steps of the model of determining a fixed number of coverings for a website. The model uses a probabilistic algorithm for the selection of a webpage from a certain set.

In the final part of the paper some conclusions and aspects that regard the modalities of the development of this method are presented.

2 The process of partitioning the set of HTML files from a website

A website is made from many built files using various web technologies, but the files which use tags are mostly the most numerous. In addition, some of these files are similar in terms of tags. A very simple example is the photo gallery, which contains mostly a very large number of web pages, one for every image. Excepting the filename and some eventual text with its meaning, the webpage is made from the same tags.

For the simplification of various operations related to websites, such as testing and verification or similarity and complexity, the usage of certain HTML web pages which are different excepting the text, tag attributes and possibly some tags becomes useful. These aspects were approached in various articles such as [1], [2] and [4] for the similarity of web applications, [3] and [7] for the measurement of the web applications complexity, [5], [6] and [11] for testing and verification.

Next, we will present a modality of partitioning the set of HTML files from a website in sets which have the property of similarity between any two web pages from the same set.

Let WS be one website. The website WS is considered to be composed of the web pages p_1, p_2, ..., p_n. We will also establish a set TG of tags.

For a web page p_i we build a sequence with all its tags, excluding those which are also in TG, keeping their order and removing their attributes.

Definition 1. Let p_i be a webpage from WS. By the sequence of tags associated to p_i, denoted by Tp_i, we understand the sequence of tags written with capitals from p_i, without attributes, which cannot be found in TG.

Definition 2. Let p_i and p_j be two web pages from WS. We state that the sequences of tags Tp_i and Tp_j associated to p_i and p_j are equal if they have the same number of components and the tags on the same position are equal. Notation: $Tp_i=Tp_j$.

For determining a partition of the set $\{p_1, p_2, ..., p_n\}$ we will use the equivalence relation defined in [3] and [5] for specifying if two web pages are similar.

Definition 3. Let p_i and p_j two web pages from WS. We state that p_i and p_j are equivalent and we use the notation $p_i \sim p_j$, if $Tp_i=Tp_j$.

It can be easily demonstrated the fact that the relation ~ is a relation of equivalence. The set of equivalence classes forms a partition for the set $\{p_1, p_2, ..., p_n\}$. We will denote by $C_1, C_2, \ldots, C_k$ these sets. C_i, with i from $\{1, 2, \ldots, k\}$, contains only web pages similar between them and for $i \neq j$ with i and j from $\{1, 2, \ldots, k\}$, any webpage from C_i is not similar with any webpage from C_j. Thus, if p_i and p_j, are two web pages from WS found in the same class, meaning that there is a from $\{1, 2, \ldots, k\}$ with p_i, p_j from C_a, then p_i and p_j are similar.

Observation

The notion of web pages similarity is depending on TG, because the less is the number of tags in TG, the finer the similarity is.

Definition 4. Any sequence of k web pages $p_{i1}, p_{i2}, \ldots, p_{ik}$ from the set $\{p_1, p_2, ..., p_n\}$ will be considered a covering for WS if p_{i1} belongs to the set C_1, …, p_{ik} belongs to the set C_k.

For the usage of less web pages, but which reflect best the way in which the website functions, we will randomly choose one or more covering sequences using an algorithm which will be presented in section IV.

3 An example of partitioning HTML files from a website

Let us consider the set TG={<HTML>, </HTML>, <HEAD>, </HEAD>, <TITLE>, </TITLE>, <BODY>, </BODY>}, the website WS composed of the web pages p_1, p_2, p_3, p_4, p_5. The files p1.html, p2.html, p3.html, p4.html, p5.html, for p_1, p_2, p_3, p_4, p_5 are the following:

p1.html

```
<HTML> <HEAD>
<TITLE>Web page p1</TITLE>
</HEAD>
```

```
<BODY>
<B> abcabcabc </B> <IMG SRC="img1.jpg">
</BODY> </HTML>
```

p2.html

```
<HTML> <HEAD>
<TITLE>Web page p2</TITLE>
</HEAD>
<BODY>
<I> abcababababa </I>
<BR> <BR>
AAAAAAAAAAAAA
</BODY> </HTML>
```

p3.html

```
<HTML> <HEAD>
<TITLE>Web page p3</TITLE>
</HEAD>
<BODY> <B> AAAAAAAA </B>
</BODY> </HTML>
```

p4.html

```
<HTML> <HEAD>
<TITLE>Web page p4</TITLE>
</HEAD>
<BODY> <I> BBBBBBBB </I>
</BODY> </HTML>
```

p5.html

```
<HTML> <HEAD>
<TITLE>Web page p5</TITLE>
</HEAD>
<BODY>
<I> PGGGDDDDGGG </I>
<BR> <BR>
<IMG SRC="img5.jpg">
</BODY> </HTML>
```

We obtain the following results:
The sequences of tags, which are not in TG, for each web page:
Tp_1=(<B>, </B>)
Tp_2=(<I>, </I>,
,
, <IMG>)
Tp_3=(<B>, </B>)
Tp_4=(<I>, </I>)
Tp_5=(<I>, </I>,
,
, <IMG>)
Thus, we obtain k=3 and $C_1=\{p_1, p_3\}$, $C_2=\{p_2, p_5\}$, $C_3=\{p_4\}$. The possible coverings are:
p_1, p_2, p_4
p_1, p_5, p_4
p_3, p_2, p_4
p_3, p_5, p_4

In the case of a website with a very large number of HTML files, the existent methods for measuring the complexity, the similarity, for verifying and testing web applications can be used more efficiently using their coverings.

4 A modality of determination of coverings with web pages for a website

The determination of all coverings for a website supposes the usage of an algorithm which uses the backtracking method, which has an exponential runtime. To avoid the usage of this method, we must do a compromise related to the number of the generated coverings. If we want a fixed number m which is not very big, then we can use a probabilistic algorithm. We will present in the next lines an algorithm of this kind.

In figure 1 the way of determining a covering for a website is presented.

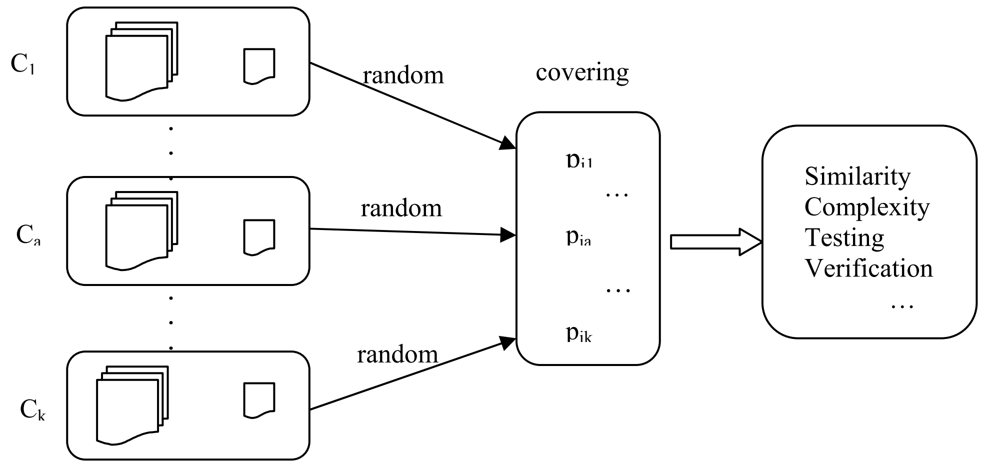

Figure 1. **Model of determination of coverings with web pages for a website**

The steps of the algorithm of determining m coverings on a website that contains n web pages denoted by $p_1, p_2, ..., p_n$ are:

Step 1. The path of the website or the URL address, the number m and the tags of the set TG are read.

Step 2. Using a breadth-first or depth-first search (details can be found in [8], [9] or [10]) of the tree associated with the web application, the file name and path which have the extension html or htm are determined. This information is stored in the unidimensional array p, n being the number of these files.

Step 3. For every webpage from the files from step 2 the sequences of tags Tp_1, Tp_2, …, Tp_n are determined.

Step 4. The classes of equivalence of web pages sets from the website, namely the sets C_1, C_2, …, C_k are determined.

Step 5. For i=1,2,…,m there is determined a website covering with web pages at a time, which is different of the ones determined previously using step 6. The coverings are stored in a bi-dimensional array (the indexes of the web pages that are part of the covering).

Step 6. For every class C_i, i=1, 2, …,k a webpage is randomly generated in order to determine a covering of the website.

Step 7. The m coverings determined at step 5 are output.

If m is approximately equal to n, then the runtime of the algorithm which was presented previously is ordinal $O(n^2 \cdot Max + Nr^2)$, where Max is the maximum number of tags from a webpage and Nr is the number of files which the website contains.

5. Conclusions

The development in a fast pace of the mechanisms of storing and accessing information on the Internet imposes various modalities of using files found in websites. This paper has the purpose of presenting a selection modality of components, which can be processed for some operations such as complexity, testing verification, copyright. In the next period we propose to make a complex application which implements the presented method.

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The Design Process and Prototype Evaluation of Special Garments in a Virtual Environment

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Abstract

The appearance of new types of raw materials has an important role in the development of the textile industry. The diversification of nowadays occupations has determined the apparition of new special products, which must protect the body from the action of the environment, but in the same time, they must allow the worker to do his/her job, as good as possible. This paper presents the design process of garments with special destination and the prototyping evaluation in virtual environments with CAD systems for the clothing industry, by taking into account the shape of the body, the type of the product, the structure and the work safety requirements.

Keywords: custom patterns, product with special destination, prototype

1 Introduction

The physical realization of the product in a manufacturing process is preceded by a conceptual stage, expressed as the product design activity and presented as a set of information that is necessary and the expected outcomes. The conceptual realization of the product has two stages: a conceptual design (made in research laboratories) and a structural and technical design (made in the production department).

The key to the functional design of clothes with the special destination is the best simulation of its protective functions and of the control mechanisms of the human body, during its activity. In the first stage, the general functions of the clothes with special destinations for different labour types, known as personal protective clothes (PPC), are simulated in a passive way, considering the influence of the textile materials from the structure of the garments. In the next stage, the level of the functions is increased or decreased as dictated by the need of adaptation to the severe environment conditions.

In order to ensure the needed level of the wearer's requirements, at least three ways are available:

-The selection of the proper materials, which meet the needed requirements of the desired functions;

-Their rational arrangement in the structure of the product (the position related to the body/ or the influence of the environmental working conditions);

-The optimization of the air volume from the product structure.

The requirements of PPC are determined by the nature, the type and the intensity of the risk factors. To design such type of clothes, it is necessary to analyse the specific conditions in which the worker should and need to operate and what technical features the equipment must have. The type of environmental factors, the level of environmental influence on the human body, the complexity of the worker’s movements and its them frequency, the worker’s dynamic, the weather conditions in which the person must work, the work and rest time period, the expenditure of the person’s energy, the duration of the use of the equipment, are important and needed information in the process of designing personal protective clothes. In the same time, when the worker moves, different forces of compression, bending and tensing are developed and they action on the materials of which the product is made. On these terms, we can say that the design activity of the PPC must be an ergonomic one, so that the worker will be able to make all needed movements according to the type of the labour, with maximal amplitude but with a minimal consumption of physical energy, in safety and comfortable conditions [1,4,5].

Different CAD system used in the clothing industry have a specialized module which allows the "virtual try on" of the cloth, by which, it is checked from a dimensional, structural and destination point of view. In correlation with its destination, the PPC is verified if it ensures the safety and protection of the worker, during his/her activity.

2 Personal protective cloth design criteria

The PPC design activity is based on the study of the worker’s movements. For example, to design the patterns for an overall protective cloth used by a mechanic worker, it is necessary to know which movements he/she must do, how often and what amplitude these have. During these movements, several body dimensions suffer important alterations, expressed by their dynamic effect (absolute or relative value) [2,5,6].

The absolute value of the dynamic effect is expressed by relation [1] and the relative value is expressed by relation [2]

[1] $d_i = X_i^{(d)} - X^{(s)}_i$, cm

[2] $e_d = \dfrac{X_i^{(d)} - X_i^{(s)}}{X_i^{(s)}} 100(\%)$

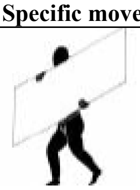
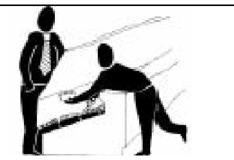
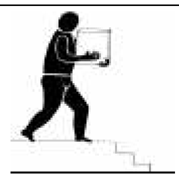
Where:

$X^{(s)}_i$ represents the anthropometric dimension measured in static conditions;

$X_i^{(d)}$ – the same anthropometric dimension measured in dynamic conditions.

Several specific movements made by the mechanic worker during he/she activity are presented in table 1.

Table 1. **Specific movements for a mechanic worker**

 Transport objects (easy and medium weights)	 Carrying	 Instable position (pick an object)	 Walking on difficult plane

The PPC ergonomic design process is focused on:

- Ensuring a dimensional correspondence between the human body and the product.

This requirement is solved by doing a correct evaluation of the freedom allowance, which is influenced by the properties of the material, the type of the required movements and the balance of the product on the human body.

- The modelling solution used to obtain the pieces from the PPC structure.

This requirement is solved by the analysis of the PPC characteristics, by figuring out how to obtain the pieces from the structure of the product, how to design the upper and lower terminations, the pockets, the closures product systems, etc. and by establishing the optimal values of all the categories of allowances.

•Comfort properties during wearing time.

The dressed body must maintain a thermal base when it moves. For this reason, the materials from the product structure must have a minimal bending rigidity and a maximal elasticity in order to diminish the value of the force needed to overcome the resistance of the product and to eliminate the worker's stress.

Specialized studies carried out by the specialists in the anthropometry field have shown that certain anthropometric dimensions, such as, the back width, the lengths of the anterior thighs and the lengths of the anterior lower limbs must be measured in several dynamic positions, because the type of the movement has a big influence on them dynamic value, while others (the knee perimeter, the second and third bust perimeter) shall be measured only in one dynamic position.

In design process of different types of PPC, the registered values corresponding to the different anthropometric dimensions in dynamic positions are compensated by the values of the freedom allowances, a component of the constructive allowance used in the mathematical relations from the pattern construction algorithm [2] by using the geometric method. By a flare or large silhouette, by the distribution of an important percentage of the allowance where the body dimensions suffer a high amount of dynamic effect, different solutions for closure systems, vents and cutline provide the worker with the possibility to do all need movements.

Research in the field of PPC design support on shoulders has shown that if the bust allowance is 5 cm, it determines a limitation of the worker's movements [5], a decrease in the amplitude and frequency and induces a quick installation of fatigue and a diminished yield. If the bust allowance is about 11 cm it is noticed an improvement in the exploitation properties of equipment intended to be used has been noticed.

3 MTM design scenario

In a world where the IT applications are used everywhere, the textile and clothing companies use specialized CIM (Computer Integrated Manufacturing) systems in all stages of the production processes. For designing and modelling patterns, several CAD systems are used in the clothing industry, such as Gemini, Lectra, Gerber, Optitex, Polytrop, Graphis, etc.

According to its complexity and destination, the design scenario requires different categories of initial data, such as the body dimensions, the product measurements and the categories of allowances. The design scenario and prototyping evaluation of the garment with special destination (PPC) are presented for an overall cloth used by a mechanic worker.

The *Made to Measure Module* is suitable to design flexible garments patterns for short orders or for custom manufacturing systems (mass customization). This module has the following areas (see figure 1), [3,7]:

1. work area→ here, the geometric constructions are displayed. In this field, one can view a geometric layer, or the patterns of the garment pieces;
2. design scenario → contains a table with script functions used for geometric constructions.
3. description area of used functions → description function, empty fields in which the necessary data is typed after they are selected (numerical values or formulas).
4. a list of initial data → in this area, the user input rates are displayed in the Edit window of the working set sizes and measurements from Table Measurements.
5. a list of geometric tools used in designing scenario- it is a list of different geometric functions, which are used to write the design scenario and draw the pattern .

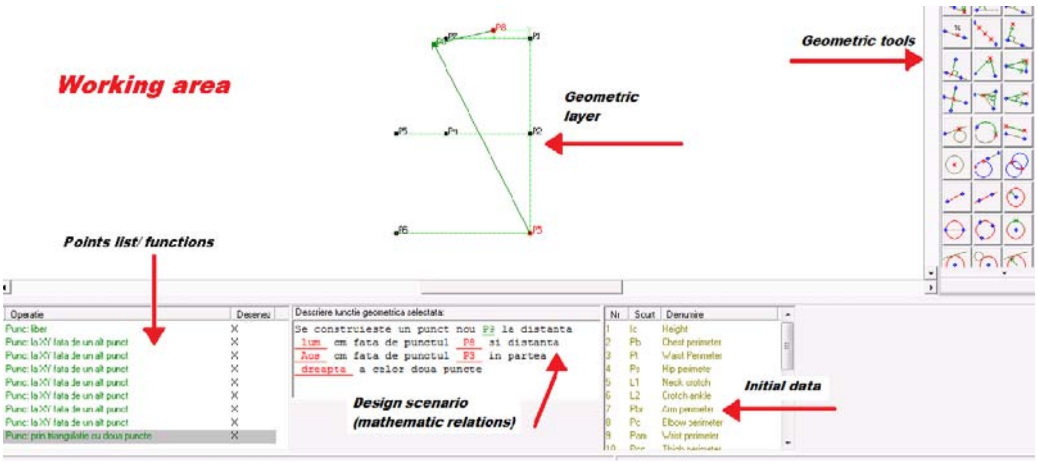


Figure 1. **Screenshot of MTM module**

For PPC, the body dimensions used to design the patterns are presented in table 2 [6].

Table 2. **Body dimensions used in pattern making**

No	Dimension name	Symbol	No	Dimension name	Symbol
1.	The body height	Ic	2.	The neck perimeter	Pg
3.	The bust perimeter	Pb	4.	The back width	ℓs
5.	The waist perimeter	Pt	6.	The front width	ℓb
7.	The hip perimeter	Ps	8.	The back length	Lt
9.	The wrist perimeter	Pam	10.	The length of upper limb	Lm.sup
11.	The length from waist to malleolus point	Lt-mal	12.	The shoulder length	ℓu
13.	The inside length of lower limbs	Lint.m.inf	14.	The lower spring of trunk	Ainf.tr

The values of the PPC dimensions and allowances are correlated with the characteristics of the material of which the product will be made and the worker's movements (mechanic field). The overall basic patterns are obtained by pairing the blouse patterns with the trousers ones. In this stage, in virtual environment it is necessary to check the shape and the dimensional correspondence of the product with the human body. If the basic patterns meet the requirements imposed by the destination of the product, the next stage is the modelling one, in which the shapes of all the pieces from the product structure are designed.

The main stages of the patterns design process in a MTM module, are:

• in the Grading module, all the needed information for the pattern design (the name and the values for all dimensions, according to the chosen design solution) is written.

alias	Cote	Height(Ic)	Chest perime	Waist Perime	Hip perimeter	Neck crotch	Crotch ankle
		182	100	84	100,9	85,9	74,5

Figure 2. **List of dimensions**

• in the MTM module are written all the mathematical relations used to dimension the patterns are written [2,3,7].

Operation description	Representation
Starting with a P1, a free point, reference point for the drawing. -positioning the level of the waist line ([P1, P3]) -positioning the level of the hip line ([P3, P4])	Create a new point P3 from point P1 at 0 cm horizontally and -Lt cm vertically Create a new point P4 from point P3 at 0 cm horizontally and -20 cm vertically
Dimensioning the pattern on the bust line -back width	Create a new point P11 from point P9 at -(ls+3,5) cm horizontally and 0 cm vertically

Gradually, each main point of the pattern is positioned in the geometric layer. After that, in the *Drawing module* connecting lines are drawn between pines (straight or curved lines) anchored to the geometrical points. In the *Modifying module,* these lines are modelled to obtain the final shape of the pattern (see figure 3).

Designing patterns with this advanced module offers some advantages, such as:

- the initial data and the structure of the mathematical relations can easily be changed (type, number and values);

- to design the same pattern for a different size it is necessary only to add/ change initial information (values of the anthropometric dimensions, the product measurements and the allowances). With this kind of module it is not necessary to grade the patterns; the shape of each piece or element is re- drawn when the initial data is changed.

-if some changes are made in the geometric layer (MTM module), these changes are automatically transferred to all the pieces of the garment which are connected to this layer.

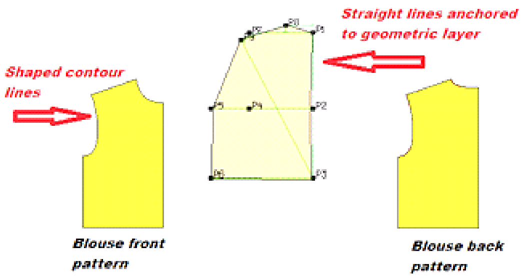


Figure 3. **Shaped patterns (In Gemini CAD System)**

After pairing the blouse patterns with the trousers ones, the basic patterns of the prototype are obtained. These patterns are imported into Modaris program (from Lectra System), see figure 4, [3]. In this program, the patterns are prepared for the 3D virtual simulation (in this module, the seam lines and the type of stitches are declared). Then, the 2D patterns are imported in Modaris 3D Fit to check if they are well designed (from a dimensional and correspondence point of view), see figure 5.

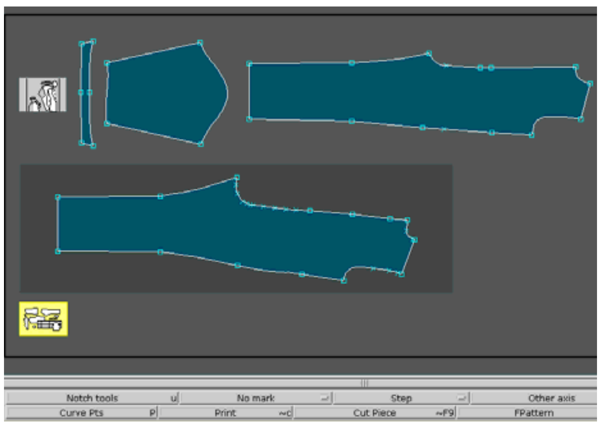


Figure 4. **The Overall patterns imported in Modaris module from Lectra Systems**

Once the 2D patterns have been placed around the body, a mechanical simulation begins, forcing the patterns to approach along the seaming lines. As results, the patterns are attached and seamed and attain a shape influenced by the body, by the number and the characteristics of the materials and by the model line (see figure 6). When the patterns meet all the mentioned requirements, these are modelled (to get all its pieces) and they are verified once again on the mannequin, in different poses.

If there are noticed any problems (the appearance of the folds or tensions) ,the patterns are changed (re-dimensioned) in order to eliminate all the mentioned problems.

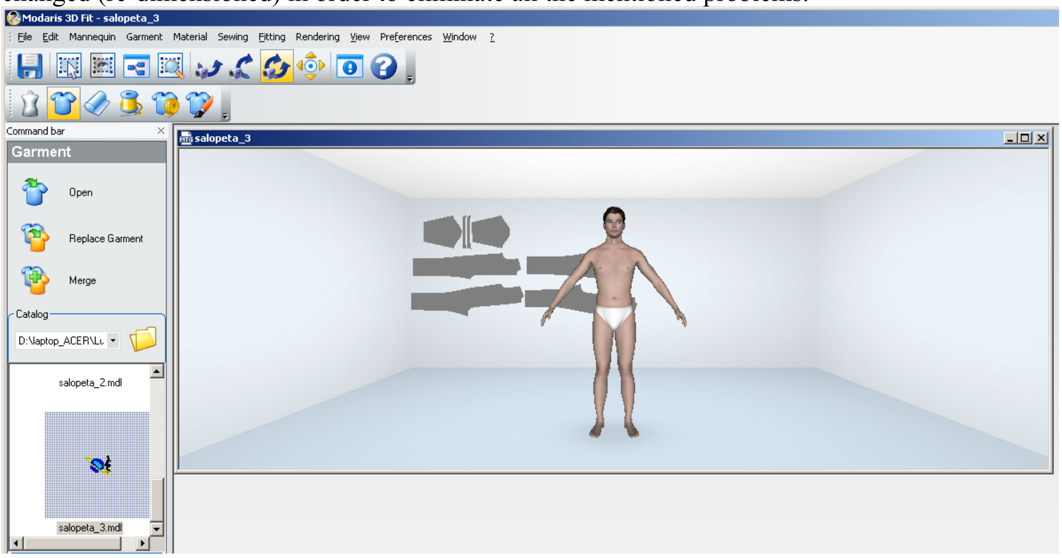


Figure 5. **Patterns imported in Modaris 3D Fit**

Figure 6. **Virtual prototype**

The balance of the product on the human body, the position of the seamlines, the outline shape of the garment compared to the body, the materials behaviour during the simulation of the manufacturing process are analysed on the virtual prototype of the PPC. If all the pieces of the PPC are well designed, it is OK to proceed to the next stage, the verification of the PPC behaviour for different types of the worker's movements.

Conclusion

In the entire world, the big companies are preoccupied to develop new materials with advanced and better properties, to design new types of garments to fulfil to all the consumer needs. In this case, it is important to have a new vision about garments with special destination, to find and adopt flexible solutions to the problem of manufacturing such garments (PPC), because it is necessary:

• To improve the protection and safety of the human body;
• To maintain thermo-physiological comfort;
• To improve the compatibility between and within different clothing components.
• To improve the manufacturing technology and to develop new materials to upgrade safety conditions.
• To reduce the manufacturing costs and to ensure the protection of the environment.

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Designing Mobile Applications for Teaching Manufacturing Technologies Course

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Abstract

Rapid developments in technology supply the equipment that can be used in teaching-learning environments and they can provide diversification about it. These new technologies facilitate learning by improving the quality of learning and this increasing students' performance. Benefiting from the technological tools in education has also triggered productivity in education and training during many educational activities. Rapidly advancing technology in recent years has demonstrated its impact on the mobile applications field as well. Mobile devices have entered into every area of daily life. Nowadays, the most common system used in mobile devices is the android operating system. Despite having hundreds of thousands applications in the Android operating system, the number of applications that will be used in education and teaching is not so much as expected. However, day by day, the number of applications that can be used in education is expected to increase. A mobile application in android operating system that is designed to be used in education has been developed. This application has been prepared in order to be used in manufacturing courses which is taught in machinery engineering department. In this practice course on manufacturing technology, course documents have been gathered under one roof in Android app. Thereby, it has been simplified for the manufacturing technology students to have access to information and documents related to the lesson.

Keywords: Android applications, manufacturing technologies, mobile devices.

1. Introduction

Nowadays the importance placed on the mobile communication also increased in parallel with increasing of the mobile phone users' number. In the last years the sizes/dimensions of the mobile phones those are of the mobile pulpits lessened, data communication speeds increased, became integrated with the different technologies and became an irreplaceable pulpits of present-day. Increasing of people's needs to the new technologies caused the Information and Communication Technologies (BIT) were used more in every field of daily life. The mobile phones and tablet computers are of the most important products of these technologies. These instruments are the technological apparatuses used most commonly, owned by humankind nowadays (Ozcan, 2013).

Particularly too many characteristics added to the mobile phones carried this apparatus beyond being a simple pulpit. Such that the individuals gained possibility to be able to perform some basic processes that can be made in computers independently from time and place, to bale to use too many communication channels at the same time, to be able to be online continuously thanks to the phones (smart phones) qualified as smart. The sales of smart phones passed the sales of computers nowadays by the result of this development experienced in the mobile phones (Canalys, 2012).

It is thought that one of the factors caused to this increase is the freedom added to the human by its mobility characteristic. Any increase is also seen in tablet using as a result of this freedom enabled by the tablets more than the other computer do (Ozcan, 2013).

The new methods and procedures were developed in the training/education depending on the fast developments in the information and communication technologies. It is an indispensable fact that how important the role of education/training is in gaining of information correctly. People always need to have training in everywhere in order to be able to comply with the developing technology because of this fact. They use the new applications that might/can be contributive and supportive to the lessons actively in order to fertilize the universities mainly and the educational institutions, the educational services (Bay and Tuzun, 2002; Gundogdu, 2009).

In this study, a mobile education/training application operating in the Android processing system was improved. The Android processing system became one of the most important mobile processing systems outstanding in the mobile world developing and advancing fast in the last years. This advancing in the Android field allowed the android applications became widespread. Thus the importance placed on the android software contributed in increasing of the number of the studies made in this field. This characteristic distinguishing the Android processing system from the other mobile processing systems allowed this software developed fast and the usage's number increased.

2. Material and method

Development of technology also increased the variety of the works made with the mobile apparatuses that the instruments used for different aim are collected in one apparatus, their sizes lessened, the portability increased and individualization according to the used processing system increased. This processing system's skills were also developed by using the Android processing system though for the mobile phones initially in the different kinds of products. Android is used in many different types of products nowadays. This usage support in the different fields contributed to its fast proliferation and development. It directed the software developers worked in this field that the mobile apparatuses need the software at the processing system's level. It was allowed to develop this processing system and the usage's rate increased by making the Android processing system that is the open recourse coded in conformity with the different apparatuses. The Android with an open recourse coded processing system, using the Linux nucleus occurred together with this orientation (Mustu, 2012).

It allowed the Android processing system moved ahead of the other mobile processing systems that the Android is the open resource coded, there are many of the application developers and there are hundreds of thousands of applications that can operate in the Android environment depending on it. Every day thousands of new Android applications are uploaded into Google Play as the Android is a mobile processing system that is set up on hundreds of millions of mobile apparatuses on the world right now. Google Play is the institutional Android application store managed by Google. These applications can also be accessible through the various sites along/besides it (Gulnar, 2012).

The Android processing system was selected in order to be used in the developed system's design as most of the students use the tablets and mobile phones commonly and they enable the free software.

2.1 Manufacture Technologies Lesson

The Manufacture Technologies lesson is one of the lessons commonly given at the departments related to the machine engineering, the manufacture engineering or the machine, of the universities at various levels. In this study it was tried to transform the lesson notes and documents belonging to this lesson given in two levels to an application operating in the android processing system by accumulating in one structure.

2.2 Android Processing System

It is an open resource coded processing system using Android, Linux nucleuses. This processing system is developed by Google, Open Handset Alliance and free software societies. The Android basically designed for the touch screens is also popular among the apparatuses having the high technology searching for the low-cost and customizable processing system. This system also started to be used in the apparatuses such as televisions, cars, game consoles, digital cameras and watches nowadays although this system was developed for only tablets and smart phones in the first years (Gelecegi Yazanlar (The Ones Who Wrote the Future) - Turkcell, 2015).

3. Designing of android application

In the designed Android lesson telling application it was paid attention that the pictures, graphics, forms and writings used were understandable, the colors used are in the integrity in screen. It was paid attention that the lessons telling would not strain eyes and the display would be net. It was taken pains that the writing was legible as/in style, colour and size. Also, very long texts were not preferred in the prepared lesson note. Thus it was tried that the information to be given became more remarkable.

The designed application consists of 4 parts:

- **Selection of Lesson:** It is the part where one of the Manufacture technologies -1" and manufacture technologies-2 lessons is selected.
- **Lesson Notes:** It is the part where there is the lesson note that was previously prepared concerning the targeted content of the lesson that has to be taught to the students and used in the lesson telling related to the manufacture technologies lesson.
- **Applications:** It is the part where the theoretical information that the students learned and the relevant part's subject are applied in the laboratory environment or daily life.
- **Questions:** It is the part where the questions to assist in reinforcing of the information learned by the students and the relevant part's subject are given.

A screen is seen as in Figure 1 when the Android application was set up and operated. There is the selection interface of the manufacture technologies-1 and 2 on/in this screen. The colour of the writing on the button transforms from white to blue and assists the users to see what he/she selected when the manufacture technologies-1 are selected for selection. This screen's display is given in Figure 2.

Figure 1. **Entry screen**

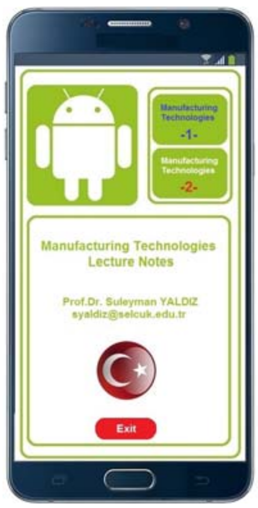

Figure 2. **Lesson selection screen**

A content page consisting of 14 parts in Figure 3 displays after the manufacture technologies -1 lesson was selected. The parts were designed in the way that one subject will be told every week. The pages where there are the lessons are accessed/passed through the part selection screen. The lesson content of the relevant part displays as in Figure 4 when 6th Part is selected as a sample. As the subject of 6th part is "the turning processes", the notes related to this lesson can be followed through here. It is determined with the blue writing in the screen that the user is in which department. Also the screen of questions and applications related to this part is accessible/passed through this screen. It is passed/accessed in order to return to any other part or home screen's display by pressing onto the relevant buttons. Therefore these buttons are used in every page and enables to switch within the program easily.

Figure 3. **Lesson's part screen**

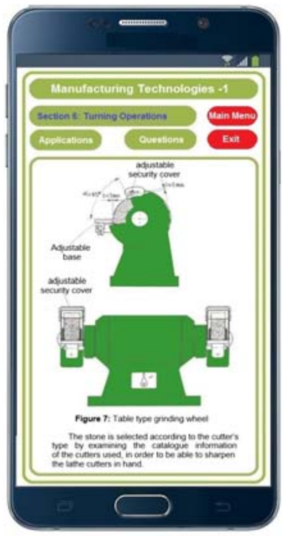

Figure 4. **Lesson telling screen**

The applications that have to be made in the relevant part display when the application in the opened page is clicked. In Figure 5, it was tried to tell the application ''to sharpen the cutters'' of the applications in Part 6 step by step to the user 6. The questions screen related to Part 6 displays as in Figure 6 when the questions button is clicked. The questions' answers are in the lessons texts.

4. Conclusion and suggestions

The number of the mobile applications developed in this field also increases day by day along with development of Android. An application was designed particularly to be used in education because of development and proliferation of tablet and phone systems. The new Android applications can/may also be designed for the other students, mainly the university students as almost all students have the mobile apparatuses using the android processing system nowadays. Such applications designed can/may be enriched much more by integrating them with the animations and simulations in conformity with the content of the lessons given. Also the effects of such applications designed on the students can/may be researched.

Such successful applications shall stimulate using of the Android processing system much more in education and also encourage the teachers to use the education methods supported by technology besides the traditional education methods.

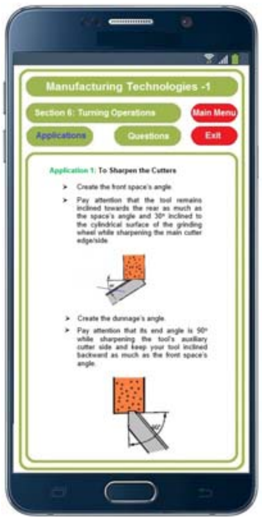

Figure 5. **Screen display of part applications**

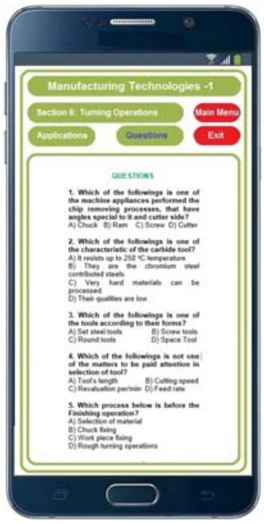

Figure 6. **Screen display of part's questions**

Acknowledgment

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Automatic Domain Specific Ontology Generation for e-Learning Context

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Abstract

Semantic web technology can influence the next generation of eLearning systems and applications. Ontology as a major component of semantic web can be used in creating meta-data for eLearning resources to foster adaptive eLearning systems. This paper presents an approach to automatically generating eLearning domain ontology based on the integration of text mining and natural language processing techniques.In this approach, domain specific terms and their relations are extracted from papers published over the last six years in proceedings of ICALT, an International Conference on Advanced Learning Technologies.After extracting domainspecific concepts, each pair of concepts gets the possibility to be linked together based on co-occurrence in articles. A weight is assigned to each edge according to the mutual information value of the pair of concepts. Effectiveness of the generated ontology is evaluated through applying itas the background knowledge to cluster eLearning documents. Proceedings of ICVL(International Conference on Virtual Learning) in two years, 2012 and 2013, are the clustering data set. The results show that inclusion of ontology increases the clustering quality.Generated ontology as an integrated knowledge extracted from different papers can be used to model educational domains and to build, organize, and update specific learning resources. Explicit representation of eLearning concepts leads to uniform tagging of these domain resources and improves results of web services in this domain.

Keywords: Ontology generation,ELearning ontology, Document clustering

Introduction

Publishing and sharing learning resources facilitate their reuse, which is the important issue in learning technology researches. It is believed that reusing learning resources generate both economical and pedagogical advantages. Deployments of some standards such as Dublin Core, IEEE LOM, and SCORM as well as consuming semantic web technologies provide tools for describing and annotating resources (Gaševiü, et al, 2005; Arch-int & Arch-int, 2013). The aim of the semantic web is to enable machines to interpret and process information so that support people in doing different works on the web, especially search (Berners-Lee, et al, 2001). Several technologies that provide formal descriptions of terms, concepts, and relationships within a given knowledge base assist semantic web to its goal. Ontology is consideredas one of the pillars of the semantic web technologies (Guizzardi & Wagner, 2004).Although there is not a universal consensus on the precise definition of ontology, it is generally accepted that ontology is a formal specification of conceptualization (R. Gruber, 1993).

In addition to reusing learning resources, the notion of ontology is becoming very useful in various eLearning applications such as user modeling, knowledge modeling of learning domain and learning process modeling (Yu, et al, 2007).However, the promises of it as a tool for semantic web are still far from being fully implemented. The critical subject in this area is ontology generation which includes identifying, defining, and entering concept definitions and their relationships. But the procedure of ontology generation is so costly and time-consuming. In addition, manual process of ontology construction requires deep understanding of the domain. Moreover, different opinions about concepts and their relation leads to different forms of ontologies, that none of them are sufficient certainty (El Idrissi, et al, 2013).(Semi-)Automatic generation of ontology can overcome some of these problems.

In this paper, we propose a method for extracting ontology from heterogeneous corpus automatically. In this respect, a hybrid method of text processing and natural language processing techniques is combined with statistical analysis to extract knowledge semantically. By applying some eLearning specific rules, the process of ontology generation focuses on this domain. This ontology is generated according to a large set of papers from a famous eLearning conference as the background knowledge. To evaluate the generated ontology, it is used to cluster papers from another well-known eLearning conference. It is worth noting that the generated ontology has a dynamic structure which allows to constantly update the directory of concepts and their corresponding relations with the introduction of new terms or relations.

The rest of the paper is as follows: In section 2 a review of the related works on ontology generation methods is presented.In section 3, we propose our approach to generate eLearning specific ontology automatically. Section 4 illustrates the effectiveness of generated ontology in an application, and finally in section 5 the work is concluded.

Related Works

Raising interests to research about semantic web, lots of methods are proposed to generate ontology.Although the manually generated ontology is much more precise and reliable, constructing ontology automatically is the central point of recent researches. However, it could be deficient since it relies only on pure data and not on human judgments.Typically ontology can be extracted from various data types such as textual data (Wong, et al, 2012), knowledge-base (Kubias, et al, 2007), relational schema (Santoso, et al, 2011), and social networks (Hamasaki, et al, 2008). Compared to other types of data, ontology generation from (un-)structured textual data has attracted the most attention. Extracting or learning ontology from text is the process of identifying terms, concepts, taxonomic relations, non-taxonomic relations and optionally axioms; and applying them to construct knowledge sources (Petasis, et al, 2011;Wong, et al, 2012).

Techniques used for processing textual data apply sets of linguistic, statistical, and machine learning methods to model and structure the information contents from textual sources(Petasis, et al, 2011; Wong, et al, 2012).Linguistic-based techniques which are mainly dependent on natural language processing tools include part-of-speech tagging, sentence parsing, syntactic structure analysis, and dependency analysis(Meijer, et al, 2014). Statistical-based techniques consist of information retrieval and data mining methods which provide various algorithms for analyzing associations between concepts (Wong, et al, 2012). Data mining methods can also be included in machine learning based techniques which extract rules and patterns out of massive datasets in a supervised or unsupervised manner(Serra, et al, 2014). In addition to these methods, some researches use external knowledge-bases to better interpret the meaning of text. Wikipedia and their link structure (Kucuk & Arslan, 2014), WordNet taxonomies(Li & Tate, 2015), and search engines (Xu, et al, 2014)are examples of these external knowledge sources.

Methodology ofOntology Generation

Domain specific ontology generation needs the strong background knowledge about that domain. If this ontology is supposed tobe extracted from several texts, they should be numerous enough to be sure about it'scomprehensible. In this respect, we take the proceedings of ICALT (International Conference on Advanced Learning Technologies) at six years as our input corpus. Following features of this dataset make it appropriate.

1. Each paper was written by one or several experts at eLearning domain and was reviewed by some other experts. So, the dataset relates to eLearning domain.
2. We select the proceedings of last six years (2009 to 2014), which contain new areas and technologies of eLearning.

An overview of the proposed methodology is shown in Figure 1, which depicts the sequence of the different data processing steps, as well as the input and output of these steps.As illustrated in this figure, the ontology is extracted in two phases. Detailed descriptions of each phase are discussed in the following.

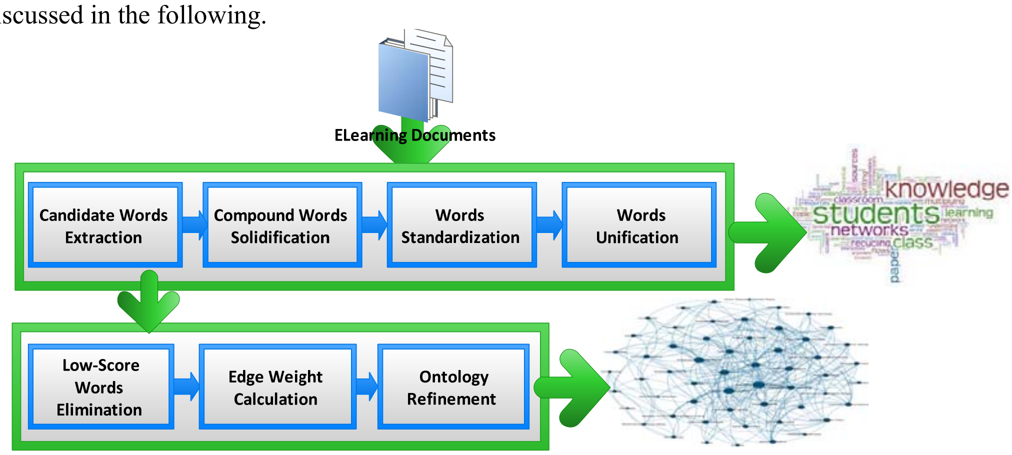

Figure 11. **Proposed methodology for ontology generation**

Pre-Processing

All the textual data from the input documents can be useful for ontology generation. But processing all parts of each document is a time consuming and complicated task. Usually the essence of each paper is summarized in the form of abstract. In addition, the title involves some main keywords of thepaper. In our proposed method, a window with the size of title and abstractis defined. The pre-processing step includes:

Candidate words extraction:This step consists of extracting the entirewords related to eLearningdomain in each paper.Many unnecessary words such as stop words which are irrelevant to the main subject may contain in each paper. Stop words including verbs such as “is”, “am” and many other verbs such as “provide”, “introduce”, etc., identifiers such as “the”, “a”, “an”, etc., and propositions such as “at”, “in”, “on”. Identifying parts of speech of the words based on their functions in sentence (noun, verb, etc.) is the first step, which is accomplished using the Stanford POS tagger(Group, 2015).

Compound words solidification:Compound words are written differently. For example “e-Learning” and “eLearning” are different representations of one word. Different forms of writing compound words (using hyphen, whitespace, or no space), summarizing either all parts of compound words or some parts (“eLearning” vs. “electronic learning”), adding or removing some parts from the compound words (“educational data mining” vs. “educational mining”), are some examples of problems with automatically identifying compound words. Although some techniques such as association rule mining can help, they all need huge corpus. We solidify compound words manually by removing hyphens, spaces and other delimiters between each part of a compound word.

Words standardization:natural language concepts may be expressed in a multitude of forms. In order to detect different forms of concepts, the similarity of multi-word expressions should be defined. Case folding and stemming are the two techniques which are used for this purpose. In case folding, all the characters of extracted words are converted to either lower case or upper case. Here, we transformed them to lowercase form. Stemming is the process of reducing words to their root forms. This is necessary since words with the same roots are considered as similar words in our method. We used Porter's Stemmer Algorithm (F. Porter, 1997).

Words unification:To avoid excessive repetitions of words in a text, their synonyms are used interchangeably. Synonyms can be merged and created a super concept in ontology. Due to lack of expertized eLearning dictionaries and high error rate in using general dictionaries, we performed this task by the judgments of human experts. In this respect, we identified all the words that have same meanings and are applied interchangeably.

Ontology Generation

This phase consists of three tasks including:

Low-score words elimination: In a large domain-specific corpus, a low frequency word can be regarded as an outlier. The word's score is defined as the number of occurrences of that word in the predefined window. By defining the top two-thirds of scores range asthe threshold, only words with higher score are preserved and all the lower score words are eliminated. In synonyms, the score of super concepts is equivalent to sum of the scores of all its sub concepts.

Edge weight calculation:regarding to statistical analysis, co-occurrence is anindicant of conceptualrelation between two terms(Qiu, et al, 2011), leads to connecting them in ontologyrepresentation. Edge weights can denote the strength of relations between conceptsand are calculated using mutual information (MI) according to equation[1]:

$$M_{ij} = \frac{f(x_i, x_j)}{f(x_i) * f(x_j)} \qquad [1]$$

In this equation, $x_i$is a concept in the ontology, $f(x_i)$ is the frequency of occurrences of $x_i$in the predefined window, and $f(x_i,x_j)$ is the frequency of occurrences of $x_i$and $x_j$together in the entire window.

Ontology refinement:In order to combine statistics and semantics in relation extraction, all the edges should be refined with some numeric and context specific rules. Based on statistical rules, a small value of MI cannot represent a conceptual relation. Therefore, defining a threshold for MI values, all the edges whose weights are lower than this threshold will be removed (one-third). Similarly, based on contextual relation, each edge should satisfy at least one of the following rules:

- An edge represents the inclusion or inheritance relation of two concepts and thus forms a concept hierarchy.
- From two concepts which are linked using an edge, one of them is a tool for doing or promoting another.
- One of the concepts involved in an edge is an action in learning or eLearning process. Verbs such as "assess", "assign", "learn", "teach", "game", "study", and "collaborate" are examples of these concepts.

Ontology Evaluation

In order to evaluate the effectiveness of generated ontology, we apply it in clustering some eLearning documents. To prevent over training, we don't use the documents applied for constructing ontology. We select the proceedings of ICVL (International Conference on Virtual Learning) at last two years as the clustering input data. Table 1 summarizes all the necessary information.

Table 1. **Information of two datasets**

Data set	Published years	Number of papers	Description
ICALT	2009 to 2014	1270	The dataset is used as the background knowledge in ontology generation
ICVL	2012 and 2013	118	The dataset is used for the purpose of clustering and ontology evaluation

Two scenarios (base-line and ontology-based) are considered to cluster the documents. Although in both approaches, the documents are represented using term vectors (some terms and their assigned weights), terms selection and weight calculation methodsof them are different. In this way, asame hierarchical agglomerative clusteringis applied on the term vectors in both scenarios and categorizes the documents.

The First Scenario: Base-Line Approach

In this approach,like the pre-processing phase in ontology generation, keywords of each document are extracted. The procedure of four tasks including candidate words extraction, compound words solidification, words standardization, and words unification is applied on each document. Using TF_IDF measure (a famous measure which is based on frequency of words) a weight is assigned to each extracted keyword.

The SecondScenario: Ontology-BasedApproach

In this approach we use the ontology concepts as the keywords of the documents. Therefore, after documentspre-processing (the four tasks of pre-processing phase) all the concepts of documents thathave involved in the ontology are nominated for weighting. The weight assigned to each concept is the sum of frequency measure and semantic relations of that concept. The proposed weighting formula is defined as [2].

$$w_i = n_i + \sum_j [-Log_{10}(E_{ij}) * n_j] \qquad [2]$$

Where w_i is the weight of word i, n_i is the value of TF_IDF for word i, E_{ij} is the weight of the edge from i to j in the ontology (i.e. the mutual information between these two words in the proposed ontology). If there's no edge between two words in the data set and their corresponding concepts in the ontology, then the second part would be zero and only TF_IDF would be considered.

Experimental Results

To evaluate the effectiveness of generated ontology, we use the famous metrics of clustering analysis. Precision, recall, and f-measure are given in equation [3], [4], [5].

$$Precision_i = \frac{N_i - \sum_j N_i}{N_i} \qquad [3]$$

$$Recall_i = \frac{N_i - \sum_j N_{ij}}{N_i - \sum_j N_{ij} + \sum_k N_{ki}} \qquad [4]$$

$$F - measure_i = 2 * \frac{Precision_i * Recall_i}{Precision_i + Recall_i} \qquad [5]$$

In these formulas, $Precision_i$ is the precision value for cluster i, N_i is the total number of objects in cluster i, N_{ij} is the number of objects related to cluster j but wrongly placed in cluster i, and N_{ki} is the number of objects related to cluster i and wrongly placed in cluster k. In both scenarios, our data is partitioned into six clusters. So, $i$takessixdifferent values. The normalized values of precisian, recall, and f-measure are reported in table 2.

Table 2. **Document clustering results**

Clustering approach	Precision	Recall	F-measure
Base-line clustering	0.508	0.601	0.539
Ontology-based clustering	0.675	0.666	0.671

From the experimental results shown in table 2, it is obvious that the ontology-based clustering method shows better performance than the base-line approach. This resultis an indicant of the effectiveness of generated ontology. However, the completeness of this ontology is an open question. Undoubtedly, the quality and quantity of background documents are so important elements in ontology construction. ELearning realm like other fields is growing and new methods, terms, concepts, and relations would be added to. Therefore, completing this ontology will not stop and growing incrementally.

Applying ontology-based clustering on eLearning documents leads to partition this data to the sub-domains of eLearning area (small granularity).We hope applying same methodology to cluster general documents such as newspapers will lead to bigger grains and much better results. Of course, this needsa comprehensive general domain ontology, which is one of the semantic web dreams. Even though, several ontologies are created separately in many domains which can be merged.

Conclusion

This paper proposed an automatic approach for generating eLearning ontology. This approach deployed statistical analysis, natural language processing, and text mining techniques in two phases. In the pre-processing phase, key concepts were extracted after four initial steps, including candidate words extraction, compound words solidification, words unification and words standardization. In the second phase, after eliminating low-score concepts, the weights of edges were calculated using mutual information. Network refinement based on semantic rules, whichwere specialized for eLearning context, was the final step in this phase.Applying the ontology as a means for semantic based clustering is a solution for evaluating it. In the clustering procedure, after pre-processing steps, concept weights were calculated in two different scenarios, including TF_IDF as the base-line and combining TF_IDF with semantic relation weights as the ontology-based method. The experimental results showed that semantic relation weights extracted from ontology have positive effects on document clustering and improve its performance.

We believe that integrating the generated ontology with content and learning management systems (CMSs and LMSs) will improve their services. Therefore, future work would involve combining ontology with a CMS. Using the CMS repository, we can incrementally refine and update the ontology and consequently betterannotatethe archives.The other future directions include finding methods that combine different features and semantics from the ontology with more advanced techniques for clustering.

Discussion

In eLearning, like many other fields of researches, ontology can easily manage the knowledge domain and allow a more detailed organization of the concepts. This research was only focused on a simple application of domain ontology. The clustering results of domain specific documents can be deployed in many applications:

- Adaptive content management systems which enhance categorizing data archives. This will increase the retrieval efficiency and accessibility.
- Recommender modules in learning systems will be able to serve more appropriate results to users.
- Conferences and any other expert panels, which receive numerous documents and must categorize them for reviewing and judging procedures, are some stockholders.

In addition to clustering, ontology can have many other applications in eLearning systems including:

- Richer annotation of learning materials is a way to deal with new learning demands, sharing, reusing, and remixing of learning objects
- Semantic querying and navigating through learning materials
- Agent based architecture of eLearning environments
- Using web services in eLearning systems

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Auto-Generative Learning Objects for IT Disciplines

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Abstract

The 21-st century skills and key competences include domains like: mathematical literacy, basic competences in science and technology, digital competences. Other important dimension considered by the european commission is the empowerment of european citizens through the digital literacy. The european IT development trend for a digital society, digital economy and IT based research and inovation requires a significant number of specialists which are hard to train with current academic resources and capacities. Learning objects LOs together with their hierarchical structures tend to be the bricks for building knowledge managed by Learning Management Systems (LMSs). Auto-generative learning objects (AGLOs) are innovative learning technologies based on reusable templates instantiated with data based on random number generators to favor the variability of learning object content. AGLOs tend to be an innovation that could support future virtual learning and long-life learning. AGLOs advantages are twofold: i) they offer automatic variability and training facilities for students and ii) provide an easy way, tool assisted for the creation of learning objects. We consider that AGLOs generative feedback is a powerful feature that helps the student to better understand the content eliminating eventual doubts. We will show that AGLOs can support several IT disciplines like: Data Structures, Functional Programming, Compiling Techniques, Operating Systems with several limitations. In order to simplify creation of AGLOs specialized libraries are developed in this sense thus several levels of intervention on content is previewed: i) easy modifications - text decorations, notations; ii) structure modifications - use of library functions; iii) library modifications - addition of new functionalities.

Keywords: learning objects, auto-gebnerative learning objects, IT disciplines, generative models

1 Introduction

Future key competences and skills include domains like: mathematical literacy, science and techology, digital competences. Big efforts are consumed in the empowerment of citizens through digital literacy because: commerce tend more and more to be digital, state administration uses software online applications to offer services to its citizens, health keeping medical devices are electronic etc. To sustain such goals there is a need for IT specialists which are trained in universities, specialized schools, companies etc.

Virtual learning is an important instrument in forming IT specialists. I this context Learning Objects (LO) are the bricks for this construction. Over time LOs were specialized as generative learning objects (GLOs) which are reusable patterns instantiated with variable content and auto-generative learning objects (AGLOs) where the generation is automatic depending on random numbers.

In this paper we will show how the generative open response exercise ideas for several IT disciplines developed in (Chirila, 2014 SOFA) can be implemented using AGLO models proposed in (Chirila, 2015 BRAIN).

The paper is structured as follows. In section 2 we present briefly the model of AGLOs. In section 3 we show how the generative exercises can be implemented using the AGLO model. Section 4 presented related works. Section 5 concludes and sets the future work.

2 The AGLO Metamodel in a Nutshell

The AGLO model was developed in several interations: (Chirila 2013, Chirila 2014 SOFA and Chirila 2015 BRAIN). The original goal was to develop a generative model allowing to express variable questions, answers and feedbacks for practical problems built as dialog games for primary and middle school students. The main idea of the model is to use expression instantiated variables based on random numbers. Thus, we can generate values to fit for a certain scenario, where the student can exercise his competences.

For example, in order to test the understanding of arrays memory representation we can choose randomly a starting address for the array and then to ask the memory address of several array elements located at several indexes. If the first attempt of the student fails then he can exercise again on a different data set, so its competence to become accurate. On the other hand a targeted feedback on the current scenario can help him understand better the learned concepts.

Structuraly an AGLO is formed out of:

i) name – the name of the AGLO;

ii) scenario – the section where the variables are defined based on random numbers;

iii) theory – a short theoretical part to be show to the student to better accomplis his task;

iv) question – the section where a question is formed out of static text and variable values;

v) answer – the section where the answer is read from the student in the form of variables in order to be assessed automatically;

vi) feedback – the section where a feedback text is composed out of static text and values to explain the student the essence of the exercise with concrete details.

From the technical point of view variables, denoted as symbols, are instantiated with JavaScript (ECMA 2011) compatible expressions, then these values are catenated with inline strings to form the sentences of the AGLOs. Values are read from the student input and stored in variables in order to be checked against correct computed answers so to give the student feedbacks and marks.

3 AGLO Models for IT Disciplines

In this section we will present the exercise ideas of (Chirila, 2014 SOFA) in the context of the AGLO model.

For the problem of applying searching and sorting algorithms we need to generate a random array and then to compute the algorithm steps using a library. These steps are easilly generated in our prototype in the demonstrative learning objects. Array lines can be easily compared and we can identify automatically any errors. In case of an error we can detect the line and the position and try to identify the comparison or move that was not understood by the student in order to explain it. The same idea of writing the algorithm steps applies to string searching algorithms. The student input facilities must be very accurate when strings are overposed in order to find a match. The solution in this case is an editor with equal width characters like "Courier New" or a custom editor to provide such an editing feature.

When a tree must be drawn having a parent indicator array available we need a tree drawing tool to allow the student to build it. The output model can be compared against the array to see if all the child-parent relations hold and that there are no extra such relations. The same strategy can be applied to build a binary tree out of an integer array using a tree editor. The verification stands in checking that the inorder elements of the tree are equal to the initial sorted array. Erasing the root twice will result in several, four in this case, tree possibilities since the removal can be made with replacement from the left or from the right subtree.

For the graph exercise where a connection matrix is given and a graph must be drawn, we can use the diagram editor to compare the models. The graph degree exercise is a simple question with an integer answer trivial to assess.

For depth-first and breadth-first graph searches the results are not singular so a verification function is necessary for the assessment.

For the minimum spanning tree of Prim algorithm the solutions are not unique when edges with equal values are available at a certain decision point. One valid choice is to make the generation as such to avoid duplicates, but we consider such cases are good to show to students for a better understanding of the concept. For Prim algorithm the steps of choosing the closest node from the unvisited set and to push it into the visited set is quite easy to analyze and assess. For Krushkal algorithm the things are much more complicated since there are two stages of the algorithm: i) sorting the edges; ii) inserting the edges and two data structures to maintain: i) the newly built tree; and ii) the node sets to prevent cycles. Maybe here we should check only the student selected edges in the main exercise and for the rest of the details to design new exercises.

In the context of list programing the first exercise proposed to use primitives like CAR, CDR to extract a symbol from a multilevel list can be tested by evaluating the query written by the student or by determining the solution by computation.

In order to exercise the ability of writing Lisp functions the randomly generated expression trees can be traversed in preorder for the assessment purposes.

In the context of compiler design discipline, for dynamically generated grammars we have two parts: lexical analyzer and syntactical analyzer. The lexical analysis automaton can be checked by ignoring state numbers which may be different and checking only the geometry of the diagrams. In order to be able to fulfill such an exercise strict rules must be set when allowing the student to design its automaton. The code written upon the automaton, namely the lexical analyzer itself, is difficult to be checked in general. A possible solution is to predefine the working data structures like: current character, atom buffer, current state variable and to show a short example of the code the student will have to write. Assessing student written code correctness is still an open challenge in the context of evaluation since there are virtually infinite code constructions with the same semantics. One solution used in programming contest competitions is blackbox testing. This approach makes impossible the generation of any feedback. Formal checking models with abstractions have a potential in solving at least partially such problems.

In the syntactic analysis part the left factoring for ambiguities elimination can be easilly tested using symbolic computation but the syntactical analyzer code can be tested only if it is written following a strict template.

To exercise operating systems competencies the exercises proposed to write several command with different arguments in the same context is quite simple for the students. A better approach is to create a new environment of directories and files and to set different targets to be accomplished using commands. The answers can be easily assessed by comparing the student command and arguments with the referenced ones according the the random context.

4 Related Works

The concept of learning object (Wiley, 2000) refers to reusable, transferable digital materials to be used for learning purposes. Standards were created in this sense e.g. Learning Oject Model (LOM) (IEEE LTSC, 2000).

The term of GLO was coined by (Boyle, 2003, Boyle 2006 and Jones et al., 2007). They implemented the idea of developing consumer LOs following a reusable pattern and filling in with content. GLOs are considered to be the second generation of LOs in this sense. GLOs adopt several principles from object-oriented programming. With our AGLOs we keep the pattern philosophy of GLOs but the generation is different.

The GLO approach of (Stuikys et al. 2007, 2008, 2009, 2013 and Damasevicius et al. 2008, 2009) use metaprogramming for the generation of content to be filled in the patterns. Our AGLO approach use metaprogramming for content generation but the main difference is that our generation is highly based on random numbers.

(MCQ, 2015) presents a model for creating generative learning objects very similar to AGLOs dedicated to mathematics and physics classes and they are integrated in Moodle (Moodle, 2015) learning management system. AGLOs rely on libraries that offer functionalities for IT disciplines.

Other uses of GLOs are presented in (Han, 2009) – where a Bloom taxonomy cognitive layers GLO is created equipped with pedagogical parameters and (Oldfield, 2008) – where a depreciation model from economy is taught using GLOs.

5 Conclusions and Future Work

In this paper we explained how the AGLO model helped by library extensions can cover several IT discipline exercises dealing with concepts like: data structures and algorithms, functional programming, lexical and syntactical analyzers, operating system commands. As future work we intend to implement a full curricula of AGLOs for several disciplines in order to test them on students. Another research direction is in the area of creation of AGLOs, of creating tools for design and generation in order to keep content construction at a lower complexity level.

Acknoledgement

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The impact of image based web technologies in educational communication

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Abstract

Measuring the impact of image based web technologies in educational communication is part of a larger theses, aimed to determine the overall impact of image based web 2.0 technologies in visual communication. In this particular chapter, we try to monitor the impact of these technologies in social progress through visual communication of academic education of two societies – Romania and the USA. To that end, we chose two renowned polytechnic universities of both countries, representative for engineering, robotics and computer programming – the most exposed areas to progress in society – Massachusetts Institute of Technology (MIT) and the Politehnica University of Timisoara (UPT). In the case study we report the presence of the university in Romania on the web 2.0 platforms to the US university presence on these platforms, determining the degree of impact of these technologies through visual communication in education.

Keywords: Education, Educational Software, web 2.0, platforms, technology

1 Introduction

Visual communication using web 2.0 platforms has become a global trend among individuals of society, being not only a tool for socialising, bot also a business card for institutions and companies, appealing especially to the young adults, the main demographic target for universities (Codefuel, 2015). Among Romanian online users, visual based web 2.0 technologies are slowly rising in preferences in the past years (Manafu, 2014). Some of these technologies are popular only with a narrow specialised audience, others are present as a tool for knowledge, information and communication for a large segment of Romanian online users (Mediafax, 2015).

The academic education system - the scope of progress-oriented society - represents a visual communication segment where quality reflects the impact on social progress collectively. Determining the impact of web 2.0 technologies among this type of communication can facilitate future predictions about the evolution of a society that gradually organizes their lives through these web 2.0 image based platforms (Andone, D., Holotescu, C., & Grosseck, G., 2014). The concern for research in this area is obvious, on one hand for determining the importance of these technologies in education and, on the other hand, for improving academic methods of communication by adapting to students' interests and the requests of modern society.

Through this study, we tried to monitor the impact of image based web 2.0 technologies using a case study. In this order, we selected 6 of the most influential platforms globally, based both on images and video.

To determine this impact, we reported the total presence of two similar universities from two different societies on these platforms. Linking Romanian education to American education, by the total presence of two polytechnic universities on web 2.0 platforms, we will consider the US society as a reference to the propagation of web 2.0 technologies, since they are created and first consumed by the American society. We will also compare the presence of selected universities in both societies on web 2.0 technologies studied, determining the percentage of impact for these technologies in visual communication of Romanian education, compared to the American one.

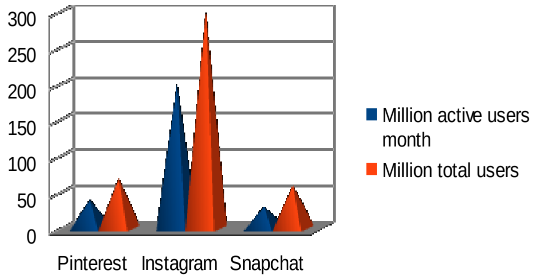

Figure 1. **Selected Web 2.0 Platforms Based on Photos for Analysis**

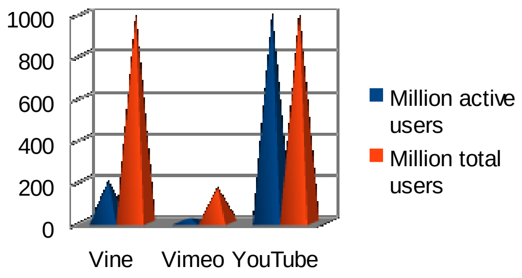

Figure 2. **Selected Web 2.0 Platforms Based on Videos for Analysis**

2 Results and Case Study

Massachusetts Institute of Technology (MIT) vs Politehnica University of Timisoara (UPT) + TeleUniversity (UPT created its own channel of media - TeleUniversity - searches on UPT will include the channel TeleU)

2.1 Massachusetts Institute of Technology (MIT)

- **Pinterest**

Even if it does not have an official page on the platform, Massachusetts Institute of Technology is found in images on Pinterest through dozens of Boards distributed to users. Among the most popular Pins distributed by users are collections of landscapes that illustrate the campus, images illustrating the technology available to American University, infographics presenting information about historical and educational offer, personalities of the university or innovative projects. Educational Communication is informal and organic in a friendly environment to Pinterest users. Pins are moderately successful and shared from 0 to 91 times. Even though the University of MIT is not formally involved in these posts, the curative feature of this platform is facilitating the distribution of educational communication organically among those interested.

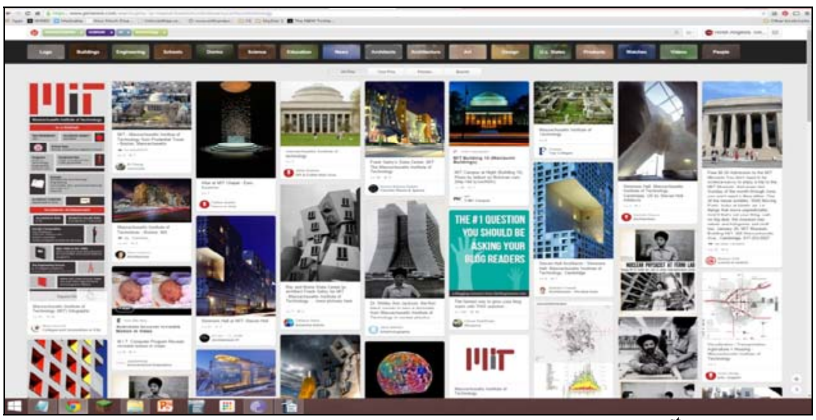

Figure 3. **Capture of MIT on Pinterest (accessed on June 1st 2015)**

- **Vine**

Massachusetts Institute of Technology (MIT) has an official channel on Vine. Even if it has not been updated since the summer of 2013 and contains only 3 videos, the channel highlights "loops" of 6 seconds with the work of the university and the educational offer. The channel has gathered some revines, likes, over 4,400 followers and more than 1,100 views of videos in the "loops".

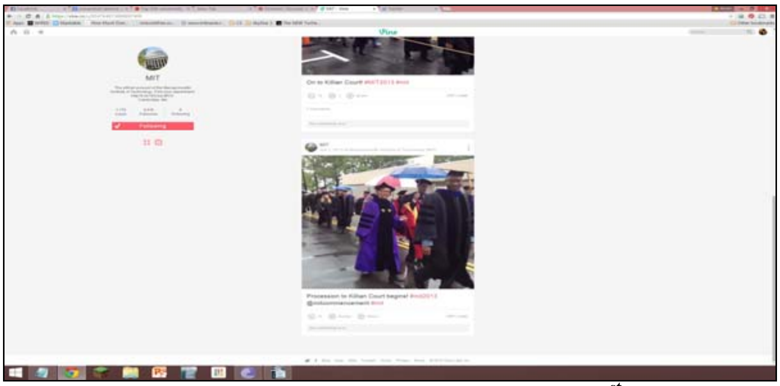

Figure 4. **Capture of MIT on Vine (accessed on June 1st 2015)**

- **Vimeo**

Massachusetts Institute of Technology is found in more than 179,000 videos on Vimeo, including promotional clips, unofficial footage from university conferences or video-graphic-research on various topics. Even if the university does not have an official channel on Vimeo, videos in which the university is mentioned or promoted have popularity, adding up to more than 500 likes.

Figure 5. **Capture of MIT on Vimeo (accessed on June 1st 2015)**

- **YouTube**

Massachusetts Institute of Technology (MIT) is present on YouTube with over 46,200 results, including the University's official channel. The channel has over 70,000 subscribers and the videos gather millions of views, presenting projects of university students, videos presenting the university and a YouTube show, that goes by the series "MIT News," which presents short scientific explanations of the various events or clips from the series "Did You Know". The channel takes full advantage of the popularity of the platform and provides youtuber' testimonials, interactive projects or presentation videos of different generations of students. Outside the videos shared through the official channel of MIT, a series of videos are shared focusing the university center by YouTube users, like "How to get into MIT", footage from classes, university-related events or personalities.

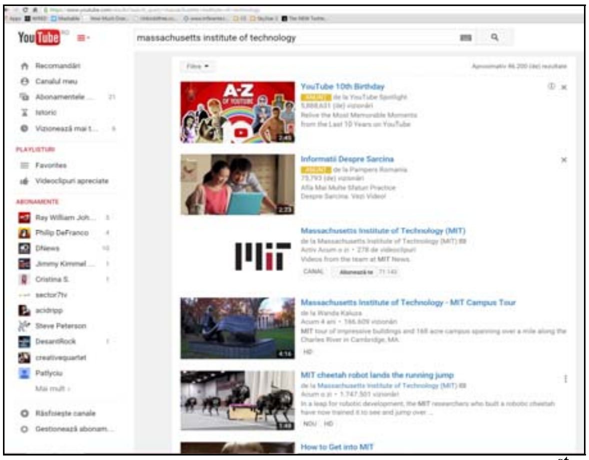

Figure 6. **Capture of MIT on YouTube (accessed on June 1st 2015)**

2.2 Politehnica University of Timisoara (UPT) + TeleUniversity (TeleU)

- **Pinterest**

Politehnica University does not have an official page on the platform, but it is found in 2 pins on a search on Pinterest. The images are pinned, originating from various web platforms, and were indexed by the keywords "Polytechnic University".

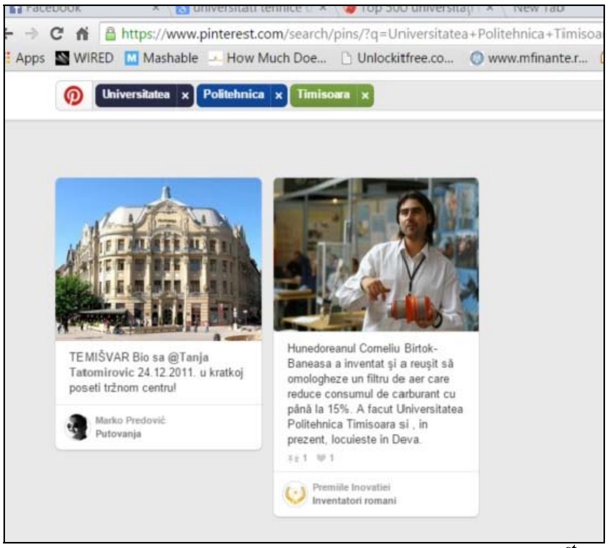

Figure 7. **Capture of UPT on Pinterest (accessed on June 1st 2015)**

- **Vimeo**

Politehnica University of Timisoara is present on Vimeo platform through its own channel representing its Tv channel - TeleUniversity. UPT has no official channel on the platform.

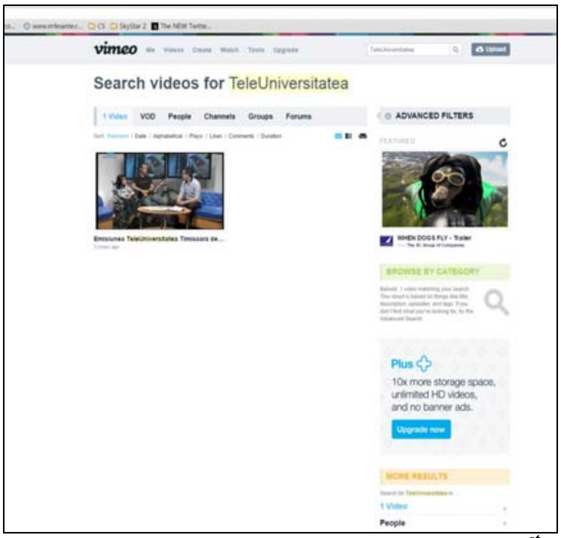

Figure 8. **Capture of UPT on Vimeo (accessed on June 1st 2015)**

- **YouTube**

With over 3,200 results on the search for Polytechnic University and 500 results for TeleUniversity, UPT has an active presence on YouTube, both through official channels of the university, and through videos regarding UPT, shared by other users.

The UPT channel has 36 subscribers and contains a video presentation of the university, in addition to video presentations for of each faculty of the institution. TeleUniversitatea Timisoara channel has 155 subscribers and contains broadcasts from the television of the University . TeleU is a product of UPT that is meant to keep students, teachers, and those outside UPT informed about events, news or performance of the UPT. Uploaded videos gather hundreds of views and are redistributed by other users on YouTube. Beyond the official YouTube channels for UPT, the university is present through other videos uploaded to YouTube informally, by other users who have participated in various events of the Polytechnic University of Timisoara.

Figure 9. **Capture of UPT on YouTube (accessed on June 1st 2015)**

3. Methodology

Through this study, we tried to monitor the impact of image based web 2.0 using a case study. To determine this impact, we reported the total presence of two similar universities from two different societies on these platforms. Linking Romanian education to American education, by the total presence of two polytechnic universities on web 2.0 platforms, we are considering the US society as a reference to the propagation of web 2.0 technologies, since they are created and first consumed by the American society. We will also compare the presence of selected universities in both societies on web 2.0 technologies studied, determining the percentage of impact for these technologies in visual communication of Romanian education, compared to the American one.

4 Contributions

Visual communication in the educational environment has great potential in terms of platforms based on web 2.0 technologies, both in terms of American society, and Romanian. The presence of both universities on these platforms is a not insignificant aspect of utility based solely on image technologies. Regarding the impact of visual communication education in Romania, the score is close to the US, which shows a high receptivity to the educational environment, in exploiting these platforms for visual communication (*Table 3. Percentage of the Presence of Both Universities on Web 2.0 platforms*).

Table 1. **Percentage of the Presence of Both Universities on Web 2.0 platforms**

PERCENTAGE FOR THE PRESENCE OF BOTH UNIVERSITIES ON IMAGE BASED WEB 2.0 PLATFORMS		
	MIT	UPT
Pinterest	★	★
Instagram		
Snapchat		
Vine	★	
Vimeo	★	★
YouTube	★	★
Total Platforms	4	3
Presence report in percentage	**66.60%**	**50.00%**

Conclusions

- Pinterest

Pinterest is noted in visual communication for a surprising impact on academics. Even if UPT's presence on this platform seems insignificant, the potential impact on this sector is all the more impressive, since this presence is a 100% organic and generated from unofficial sources of the University. However, this presence is comparable to the US counterpart, MIT, on the same network. On a slightly larger scale, the USes impact on Pinterest's academic communication is comparable to that of Romania – both are generated 100% organic without official intervention of University representatives.

- Vimeo

Another surprising aspect worth noting is the presence of academic communication via Vimeo. If the communication of the US presence is on larger scale, in Romanian education, the presence of a single environment. Of course, in quantitative terms, this presence can be considered insignificant, but given the quality of the platform, the impact of Universities on Vimeo can be an extremely useful communication tool for education.

- YouTube

Known as a technology whose main feature is versatility, YouTube is an excellent means of communication in the field of academic education - both in the US and in Romania. The presence of YouTube universities gather views from a significant number of users and promotion strategies through the platform can be adapted in a variety of ways, either of formal or informal nature.

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Exploring Problems Faced by Post Graduate Students of Virtual University Pakistan

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Abstract

The Virtual University is the first Pakistani University based completely on modern information and communication technologies. The university was established in 2002. One hundred cities of the country are facilitating students on providing infrastructure. During the last three years the dropout rate was continuously increasing. The administration showed the interest to know the problems of students. The main objectives of the study were to find out the causes of dropout and to develop suggestions for improvement. The study was qualitative in nature. A Performa was designed to know the reasons with demographic variables. The data was collected from the drop out students of April, 01, 2014 to March, 30 2015. There were 594 students in all. All the students were enrolled in different post graduate classes and unable to complete their degrees. A seminar was conducted and asked them to participate. The Performa was distributed to all students and asked them to write the reason for leaving university. All the reasons were grouped and five major reasons were identified. The major reasons were: unable to understand VU mode of instructions, time problem, financial problems, job restrictions and domestic problems. The recommendations were made in the light of findings to minimize the dropout rate of the students.

Keywords: E-learning, Problems of post graduate students, Virtual University

1 Introduction

Education is the major difference in man's individual and nation's progress. No individual and nation can have high ranks among human beings and nations without education. Without education the future of the individuals and nations is the ultimate darkness. No vision, no respectable place and option to lead successful life with dignity.

Pakistan, since its birth, realized the importance of education and tried its best to materialize the dream of educating the whole nation. The education Policy was announced immediate after its establishment wherein it was determined to educate all Pakistani people. Earlier the mode of education was the formal education.

Formal education has its own barriers and it is a proven fact that no country can impart education to its whole population by the using the formal education mode alone. It has limited capacity in terms of student enrollment. It is also much costly and time consuming as well.

Realizing the fact, Allama Iqbal Open University was established in 1974 with objective to extend education throughout the Pakistan by Non Formal education. In this method people can study at their home but still they have to visit physically their teacher for guidance and for workshop in each semester. AIOU mode of education was actually the blend of distance education and formal education. And whereas the quality of education was concerned, it was also questionable due to different educational capacities of the tutors of different areas. Student support service of the AIOU was of low level and quite slow as well.

For the solution of all these problems it was decided to set up a university to impart the quality and standard education at affordable fee to the people of the Pakistan within the country and abroad at their door step using the latest ICT technologies. In result virtual university of Pakistan was established in 2002.

Virtual university of Pakistan is the pioneer university that adopted the ICT technologies to impart the education with slogan “Education at Your Door Step”. Initially two satellite TV channels namely VTV1 and VTV2 were established with state of art studios for the recordings of lectures. Now it has its four TV channels namely VUTV1 to VUTV4 that can be accessed through Pak sat satellite.

To extend the quality of education with standard VU selected top level scholars from the top ranking universities of the country and got the video lectures recorded from them against the courses to be offered . Allied material i.eppt lecture slides, lecture hand outs were also get prepared by the same scholar. These lectures are broadcasted from VU TV channels that can be watched anywhere in the world.

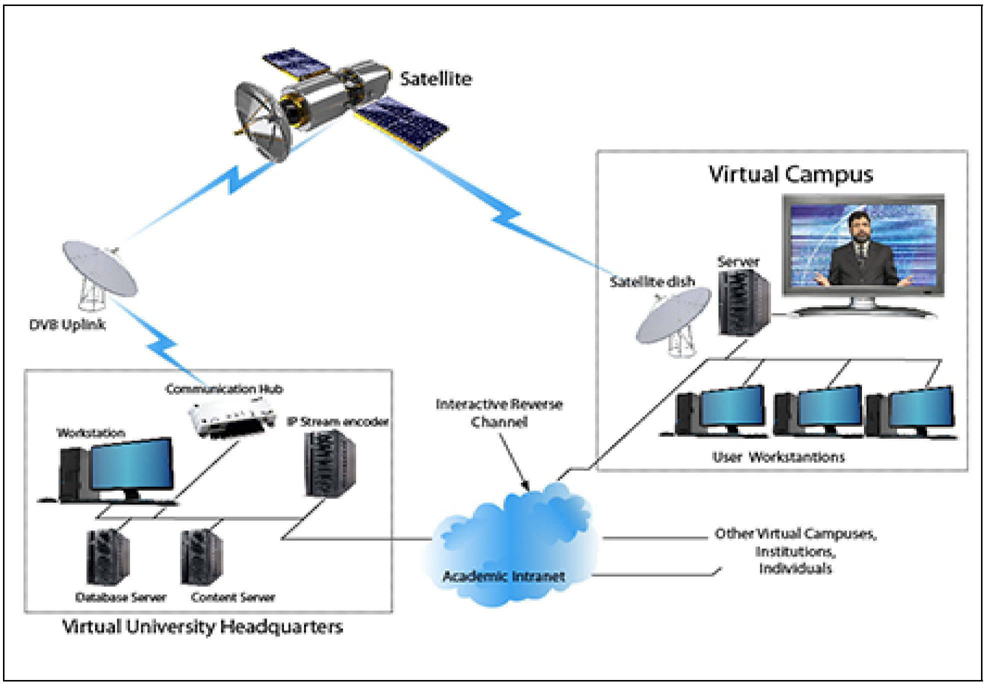

Fig. 1 **Virtual Campus Scheme**

VU has developed its own open courseware (http://ocw.vu.edu.pk/) that was ranked as No 1 in the world.

Fig. 2 **Open Course – Virtual University of Pakistan**

VU student may watch these video lectures at any time however VU give lecture schedule for better time management. CDs of these lectures are also available at VU online bookshop. VU developed its unique learning management system name "Virtual Learning Management System (VULMS).The whole academic activity and student support services activities happen through VULMS.

As the student is enrolled at VU, he/she is give unique student ID& password to login the VULMS to continue his/her study. Every student is given an Email ID as well to communicate with VU offices for any information and problem. No student needs to visit physically at VU for the solution of any problem. It is solved on emails.

Students interact with other students and teachers through VULMS, student receive and submit assignments through LMS and they also participate the discussion on certain topic through MDBs(Moderated Discussion Boards).

VU has developed its own unique exam system date sheet interface is opened one month before the commencement of exam and students are asked to make their own datasheet in accordance with their time availability and then exam is conducted accordingly. Exam is conducted online , Local Pakistani students have to appear in designated exam centers however overseas students may appear in exam from the place where they can arrange computer and external web cam with stable internet connection.

In fact virtual university has adopted a unique mode of education, that is why it has more than one hundred thousand students and almost 20 thousands new students are enrolled per year. But a large number of drops out have also been observed from the last some years. It is very alarming because such large number of drop out of the students may create problems for the existence of virtual university. It has much concern and needs to be investigated.

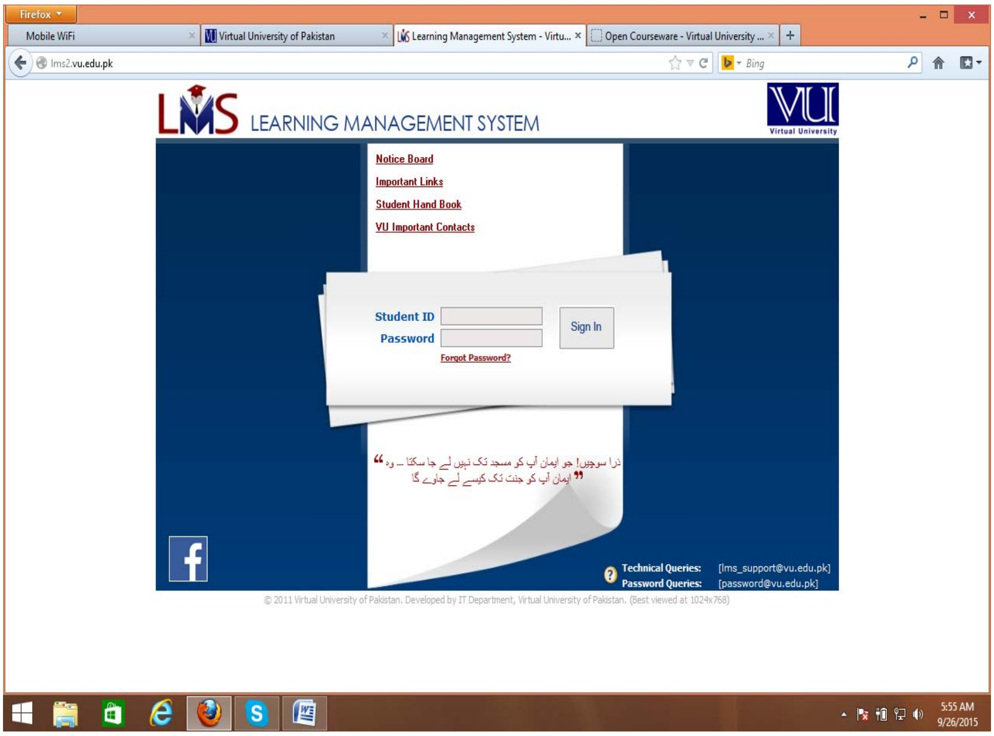

Fig. 3 **Input LMS – Virtual University of Pakistan**

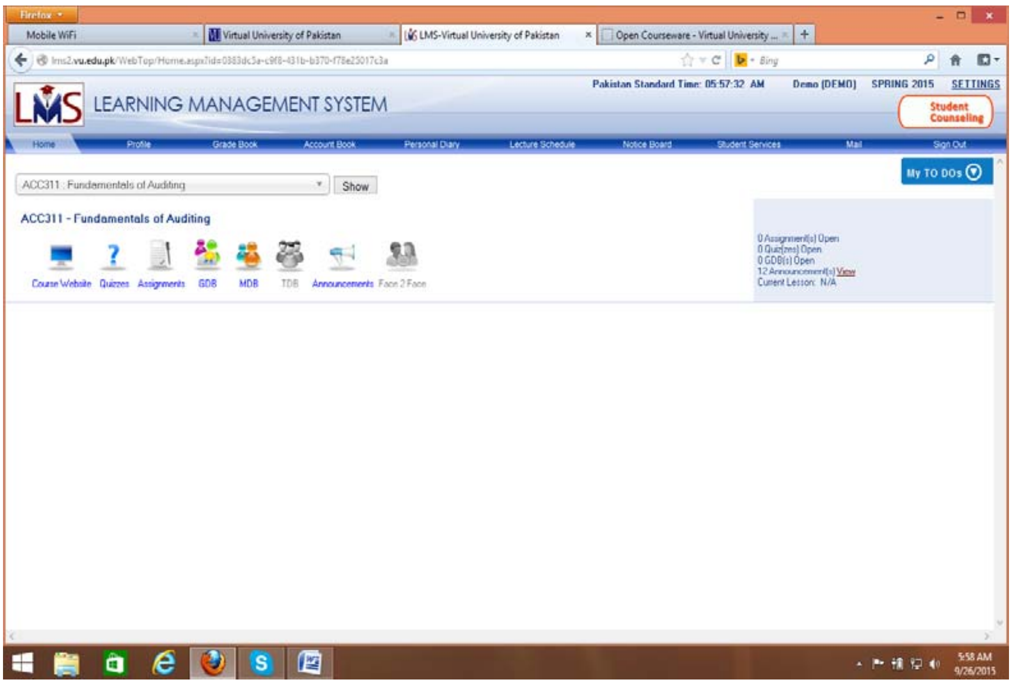

Fig. 4 **LMS – Virtual University of Pakistan**

2 Back ground of the Study

Higher education research related to retention can be traced back over 70 years (Braxton, 2000) with much of the research predating 1970 (e.g., Astin, 1964; Bayer, 1968; Vaughan, 1968). Two seminal works were published in 1975: Astin's (1975) book, *Preventing Students from Dropping Out,* and Tinto's (1975) internationalist theory serve as foundational knowledge related to retention in higher education. Astin studied individual student characteristics (such as gender, age, and place of residency) and institutional characteristics (such as type, location, and selectivity) to determine how such variables affected student retention. Tinto (1975) developed a theory that incorporated a student's commitment to an institution, aspirations for a degree, and integration into the academic and social life of a campus. According to Tinto's (1975, 1987) theory, high levels of integration into academic life of an institution led to a greater commitment to the institution. A greater commitment and integration led to a greater likelihood that the student would be retained (Braxton, 2000; Braxton & Lien, 2000; Tinto, 1975, 1987). Braxton (2000) posited that scholarly inquiry into the reasons why students leave higher education stalled in the mid-1990s with the wholesale acceptance of Tinto's (1987) model. He called for new research that would "reinvigorate scholarly inquiry on the departure puzzle" (p. 3). Coupled with the rapidly changing demographics of college students (Keller, 2001; Pascarella & Terenzini, 998), this stall may suggest a need to reconsider the effects of several variables that predict student retention.

3 Methodology

The study was qualitative in nature. The data was collected from the drop out students of April, 01, 2014 to March, 30 2015. There were 594 students in all. All the students were enrolled in different post graduate classes and unable to complete their degrees. A seminar was conducted and asked them to participate. The Performa was distributed to all students and asked them to write the reason for leaving university. All the reasons were grouped and five major reasons were identified

4 Conclusions

The major reasons were: unable to understand VU mode of instructions, time problem, financial problems, job restrictions and domestic problems. The recommendations were made in the light of findings to minimize the dropout rate of the students. It was recommended that Virtual University should arrange an orientation program for all students in the beginning of the session. The university may also be announced scholarships for needy students. There may be more flexibility in study duration.

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E-learning system based on A.U.M.P.S. (Adaptive Unified Management and Production System) concept

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Abstract

The strategy for improving the learning process in high education field must integrate new and modern teaching systems. For this reason many professors have tried to develop methods to improve the learning process. The main objective of this article is to present a new method for e-learning systems development. This solution will help the professors to build their own systems based on any study plan. This paper will show a solution connected with a new concept to improve the learning process for any e-learning systems. The proposed solution, called A.U.M.P.S. (Adaptive Unified Management and Production System) integrate in the same platform theoretical principles of any education subject, applications and tests through databases in order to simplify the process of modern e-learning systems development.

Keywords: Adaptive Unified Management and Production System , dynamic web language, databases, e-learning

1. Introduction

The Internet integration in education field and the development of the new e-learning platforms, it continuously felt the need to take another view in presenting theoretical concepts to students and also the approach of how to access the information's in the new digitalization context. The courses are stored on a computer in a specific method and also a special program allows students to access the learning information. The lesson could be presented in a digital mode or a multimedia format a combination of text, sound, pictures and movies.

The course materials digitalization has a number of advantages like:

- the elimination of storage space necessity;
- flexibility in student access only for courses parts ;
- the sending of the materials to the student exactly on time
- the providing access to lessons when and where are necessary;
- the integration of a variety of learning elements: text, graphics, images, sounds and movies;
- real time communication with professors and other students.

At the conceptual level the proposed solution could be used to any type of system, especially to e-learning systems.

To improve learning, the proposed solution will integrate the principles of building informatics systems as information system platform with theoretical knowledge and specific test application modules and educational processes. This article will present a concept for developing an integrated informatics structure directly in databases for improving learning processes.

2. Proposed concept elements in an e-learning system development

The A.U.M.P.S. (Adaptive Unified Management and Production System) method reduces the cost of investment in informatics technology because of the platform needs to run in universal system for data access. This thing is possible due to the use of only a single node of servers, with a single license for all terminals that are connect to it and the also the use of old computers that want to access without making upgrades to them.

Another advantage is the quick access to learning materials from anywhere in the world without the need for specialized client programs. It should be noted that after building a system based on the new concept, the system can be easy translate into cloud technology without requiring major adjustments to the system structure.

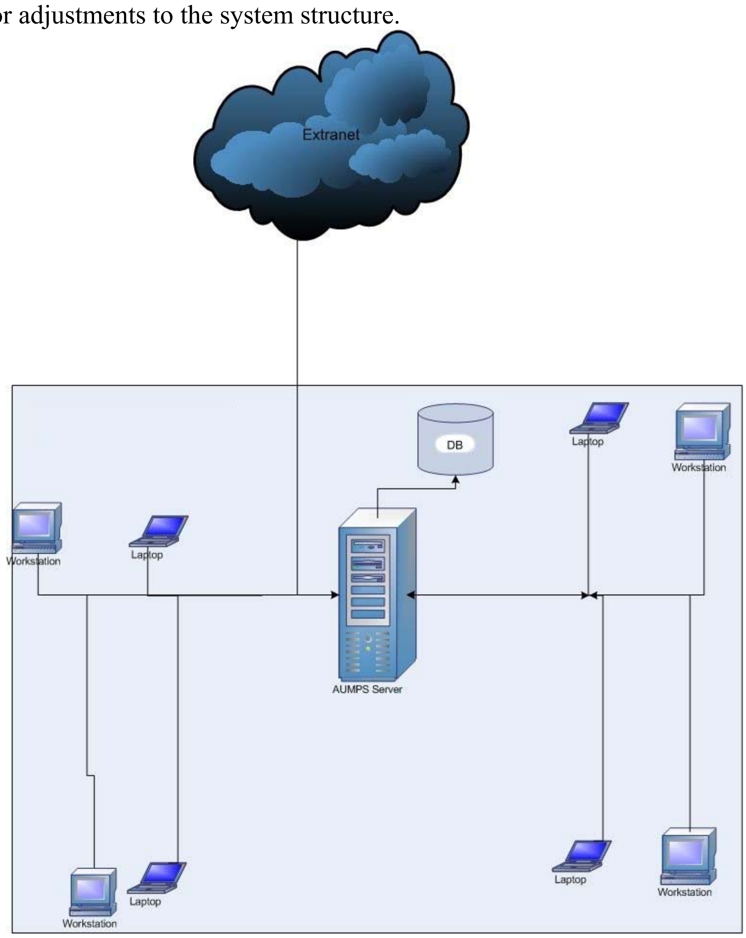

Fig. 1. **E-learning system access**

The development of e-learning systems based on A.U.M.P.S. concept has some benefits like:

- The system uses only a single node of servers for running.
- The operating system on this server can be UNIX, Linux or Windows or mobile operating systems. The system can run on any of the 3 operating systems without having to rewrite code.
- It is not necessary to have any special software client-server for data access.
- No need to change the infrastructure of the technology running the informatics system, the system can run on older computers that have network or internet connection.
- Can run on any mobile device with Internet access using a web browser.
- Management within the system realizes using electronic signature system.
- The entire organization of courses and materials in the program can be done directly without having to use of papers.
- The system has the possibility of saving any files created in other applications.

3. The study of functional diagram of the proposed system

The developing of an e-learning system has considered in addition to the matters listed in the previous section, which is desired to build a system that uses temporary programs, programs whose source code is implemented by SQL techniques directly in database structure. Beginning with this idea it be could identified a structure in which the elements (forms, queries, menu, etc.) of a first module are retrieved by a query from a table of codes and sent to a compiler that will generate a temporary program. This method is call A.U.M.P.S. because it use the programing code directly in database and the require modules of the e-learning system are compile on demand.

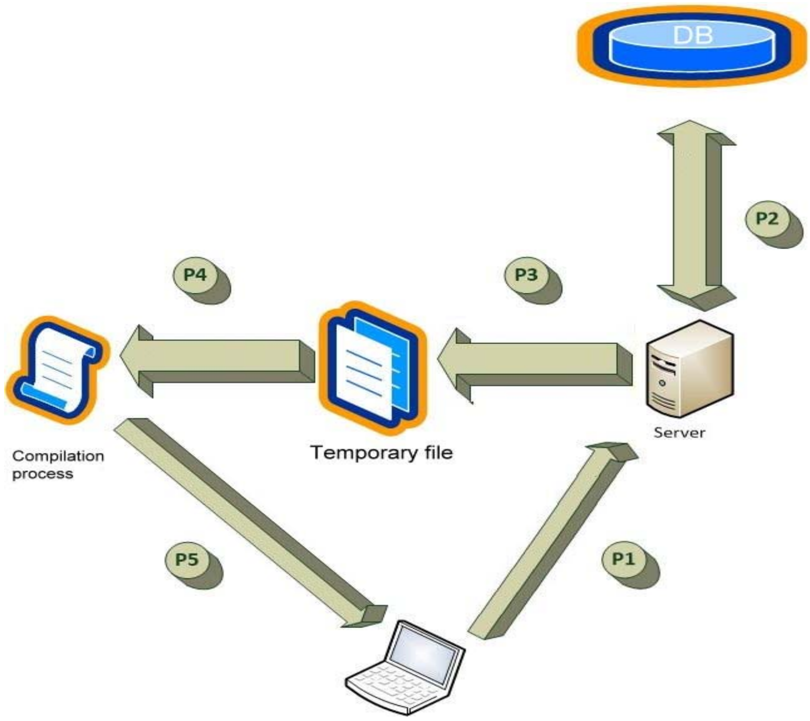

Fig. 2. **Diagram of e-learning system access**

This solution will allow a reduction of resources required for the operations because the computer system will run only those portions of module that are necessaries for user at one moment of time. Figure 2 presented a diagram of e-learning system access.

By this way of developing systems a nineteen percent of the source code will be stored in the database, the remaining of ten percent consisting of:

- gcwin compiler, along with all the components of its operations;
- dll libraries and files;
- template compilation, which will be achieved by using queries calling “Compiler method for generating temporary programs”;
- low operating system resources.

As mentioned above, the purpose of the article is to present an e-learning system that is built using a new concept based entirely on data bases. Figure 3 will present the following scheme.

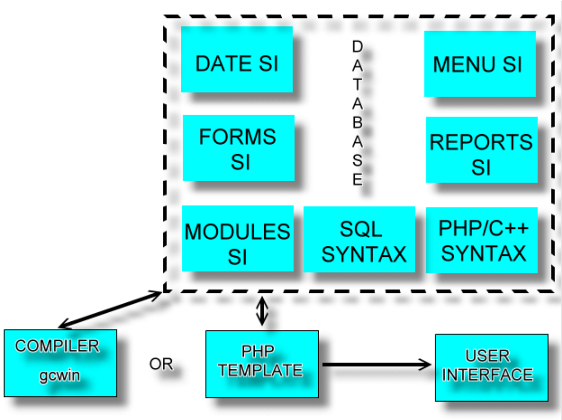

Fig. 3. **Functional diagram**

As it can be seen from the functional diagram, the e-learning system will be developed inside the database structure and not outside of it. This means that building the structural menus, forms, reports, etc. will not be developed through the classic software. This type of process will generate temporary items call them by user need.

For example if we generate a program written in C++ language test module, we actually generate multiple files under a particular extension. In the proposed method these files no longer exist, their place being taken by a single file called template for compilation / interpretation that has a sequence of SQL code, required to retrieve the source code to generate temporary files used by user.

The template for compilation / interpretation will have two roles:

1. Compiler role – the possibility to extract file based sequences implemented in SQL code, the database code necessary to compile the necessary runtime compiler file gcwin for specific part of e-learning system.

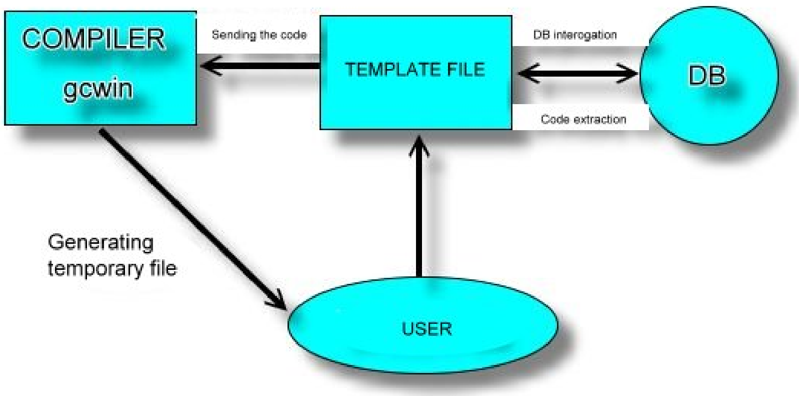

Fig. 4. **Compiler process**

2. The interpreter role – the system developers will be able to focus on dynamic language PHP, which is an interpreted language by the internet browsers using web servers.

The proposed concept for building e-learning systems has the following advantages:

- a system could be modified and adapted in a dynamic way, without having to recompile the entire e-learning system;

- it no longer necessary for file encryption and this will not be their decryption operation.
- the system no longer requires a large installation space because it is based on generating temporary structures;
- the system has a high speed data access;
- the system has a large compatibility with mobile operating systems due to its structure.

4. Conclusion

The main objective of this paper was to present a new concept to develop an e-learning system using the Adaptive Unified Management and Production System method. At this moment the proposed informatics solution is at the beginning but after more theoretical study and the implementation could become a successful story. The paper presented the main idea and the steps for an e-learning system development using Adaptive Unified Management and Production System (A.U.M.P.S.) concept for improving the education process. The principles of this concept could be used to develop a performing and modern e-learning system focused on student education. Also this article illustrated the main benefits of using of this concept for an e-learning system development and also presented a number of advantages. Because of this, the e-learning systems become more efficient and also are opened to more and more students and professors that want how to have access to knowledge and also to learn new skills in education domain more rapidly.

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Students' computer-based distribution in high school based on options as an extension of SEI distribution program

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Abstract

High school admission is carried out at the country level using a complex application from the SEI program. But this application does not cover the students' distribution to the profile classes for each school. This distribution is generally made in order to offer students the possibility of choosing the wanted class function of the graduation grade to assure a good student - teacher communication. In this paper we want to present a way of implementing the distribution algorithm, based on the admission grade (graduation grade and National Exam grade), but also according to the order of the classes the student choose.

Keywords: high school admission, options, distribution algorithm.

1. Introduction

Throughout the years a lot of systems for classifying a group of people according to exams results were developed. Nowadays, in many countries systems like the SEI platform developed by SIVECO in Romania were implemented. This system creates a national database with students' exam results, and uses it in the high school admission, according to each student's choices. More details can be found in [3] and [4]. The system offers a lot of information like the number of students admitted in high schools, for each profile. The instructions for using this platform are presented in [1], [6] and [7].

After the national distribution on high schools follows the students' distribution in classes. If there are more classes on the same profile, a fair distribution in the classes according to the admission grade and the options must be performed. This article aims at presenting an application that solves this problem.

In the section II are presented input and output data issues and the method of placing the students in the same profile classes.

In the section III is described the distribution algorithm.

In the section IV is shown the application written in C++ using Code::Blocks IDE, but also the usage and the results obtained with this application.

The last section is reserved to conclusions and future work.

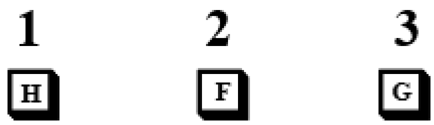
The application presented was used in the last two years with very good results in various high schools using the data from SEI and the students' options. We consider this is a natural follow to the national computer-based students' distribution.

2. Input and output data for the application

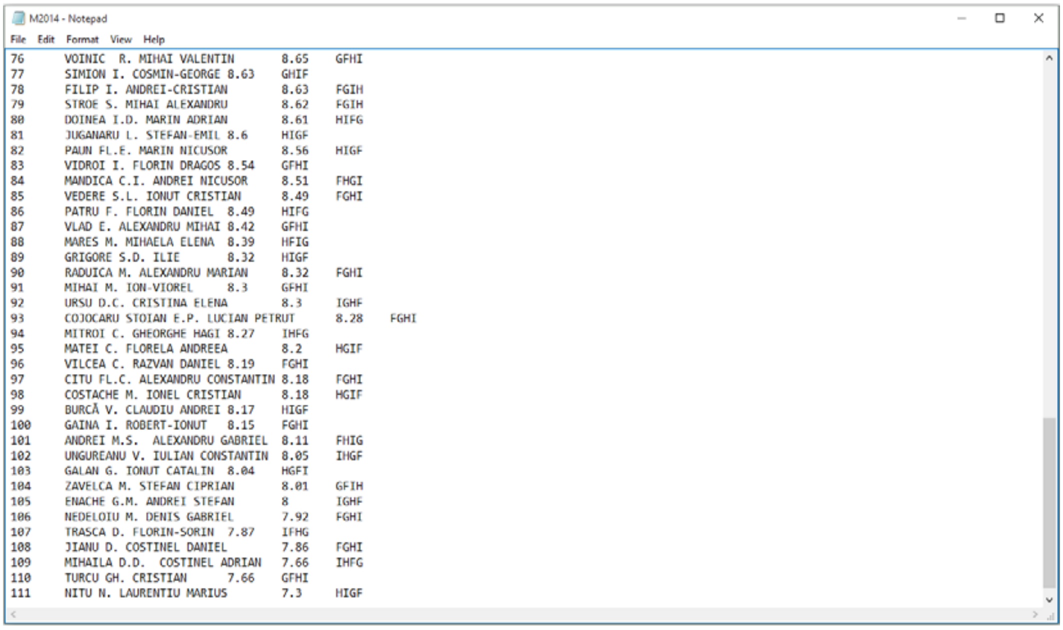
The algorithm used in the application requires as input data a text file obtained with the data from the SEI system, on the website [2], where can be found the name, the school and the admission grade. The files must contain also the students' options from the admission form as below:

C_1 C_2 … C_n, where C_i means the i^{th} class the student chooses, and n - the number of classes of the profile.

Example:



Below you can see an input file used in the application:



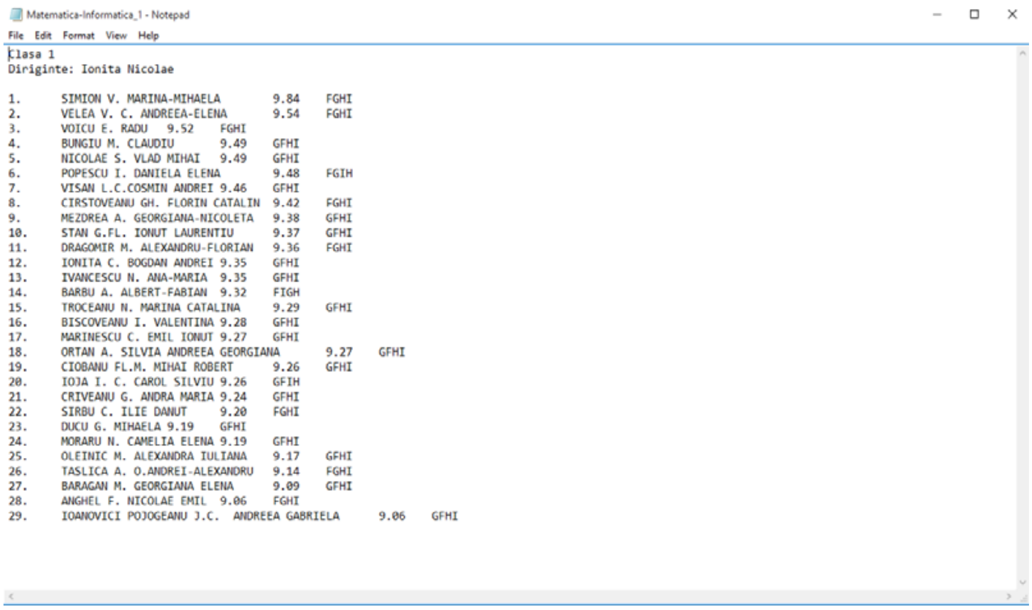
```
M2014 - Notepad
File  Edit  Format  View  Help
76      VOINIC  R. MIHAI VALENTIN       8.65    GFHI
77      SIMION I. COSMIN-GEORGE 8.63    GHIF
78      FILIP I. ANDREI-CRISTIAN        8.63    FGIH
79      STROE S. MIHAI ALEXANDRU        8.62    FGIH
80      DOINEA I.D. MARIN ADRIAN        8.61    HIFG
81      JUGANARU L. STEFAN-EMIL 8.6     HIGF
82      PAUN FL.E. MARIN NICUSOR        8.56    HIGF
83      VIDROI I. FLORIN DRAGOS 8.54    GFHI
84      MANDICA C.I. ANDREI NICUSOR     8.51    FHGI
85      VEDERE S.L. IONUT CRISTIAN      8.49    FGHI
86      PATRU F. FLORIN DANIEL  8.49    HIFG
87      VLAD E. ALEXANDRU MIHAI 8.42    GFHI
88      MARES M. MIHAELA ELENA  8.39    HFIG
89      GRIGORE S.D. ILIE       8.32    HIGF
90      RADUICA M. ALEXANDRU MARIAN     8.32    FGHI
91      MIHAI M. ION-VIOREL     8.3     GFHI
92      URSU D.C. CRISTINA ELENA        8.3     IGHF
93      COJOCARU STOIAN E.P. LUCIAN PETRUT      8.28    FGHI
94      MITROI C. GHEORGHE HAGI 8.27    IHFG
95      MATEI C. FLORELA ANDREEA        8.2     HGIF
96      VILCEA C. RAZVAN DANIEL 8.19    FGHI
97      CITU FL.C. ALEXANDRU CONSTANTIN 8.18    FGHI
98      COSTACHE M. IONEL CRISTIAN      8.18    HGIF
99      BURCĂ V. CLAUDIU ANDREI 8.17    HIGF
100     GAINA I. ROBERT-IONUT   8.15    FGHI
101     ANDREI M.S.  ALEXANDRU GABRIEL  8.11    FHIG
102     UNGUREANU V. IULIAN CONSTANTIN  8.05    IHGF
103     GALAN G. IONUT CATALIN  8.04    HGFI
104     ZAVELCA M. STEFAN CIPRIAN       8.01    GFIH
105     ENACHE G.M. ANDREI STEFAN       8       IGHF
106     NEDELOIU M. DENIS GABRIEL       7.92    FGHI
107     TRASCA D. FLORIN-SORIN  7.87    IFHG
108     JIANU D. COSTINEL DANIEL        7.86    FGHI
109     MIHAILA D.D.  COSTINEL ADRIAN   7.66    IHFG
110     TURCU GH. CRISTIAN      7.66    GFHI
111     NITU N. LAURENTIU MARIUS        7.3     HIGF
```

We have to mention the fact that in the high school, for a study level, the classes are encoded with the letters A, B, C, … and on the same profile could be several classes, generally encoded with successive letters as in the previous example.

So that these files be complete, the name of the class master and the number of students from each class were also added.

The output data is stored in text files, one for each class.

Example:



3. The algorithm used

According to the items mentioned in the section III, the application uses a student's data processing algorithm, which gathers students admitted to the current high school and sorts them descending by the admission grade. Then, each student is assigned to the first free place found in the options list. In order to do this, we make use of the following data structures:

t – the number of classes.

E[i]; – A structure that include the admission grade, the name and the student's options.

class[i] – the number of students assigned at the moment in the i^{th} class of the profile.

r[i][j] – the order number of the j^{th} student from the i^{th} class of the profile.

C[i] – the maximum number of students from the i class. (initially C[i]=nr, i=1,t)

Pseudocode:

```
begin
struct
{
    int m;
    char name[], o[];
}E[1000];
int class[10], r[10][100], C[10];
int nr; //initial number of students in a class
int t; //number of classes
int n; //total number of students

read nr;
for i=1 to t  C[i] ← nr;

read_input_files(); // initializes the structure E[].
sort(E); //sorts the students by admission grade
```

```
for i=1 to n
        j←0;
        while ( E[i].o[j] <> 0 ) //iterate each option
                k ← E[i].o[j];
                if  (class[k]<C[k]) //we have a free position in kth class
                        class[k] ← class[k]+1;
                        r[k][class[k]]=i;
                        break;

                else if (class[k]==C[k] && E[i].m==E[r[k][class[k]]].m) //the same grade with the last student from the kth class
                        C[k] ← C[k]+1; //increase the number of students in kth class
                        class[k] ← class[k]+1;
                        r[k][class[k]]=i;
                        break;
                j←j+1;
        end while.
end for.

write_output_files();
end.
```

4. Implementation

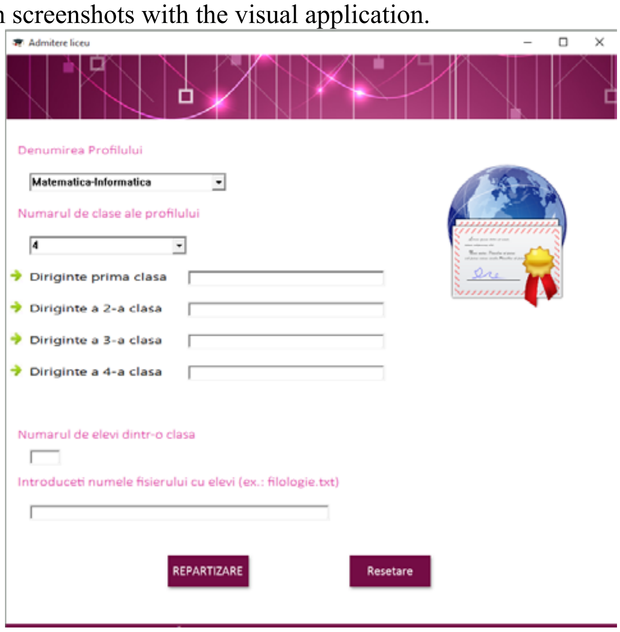
The algorithm above was implemented in C++ programming language.

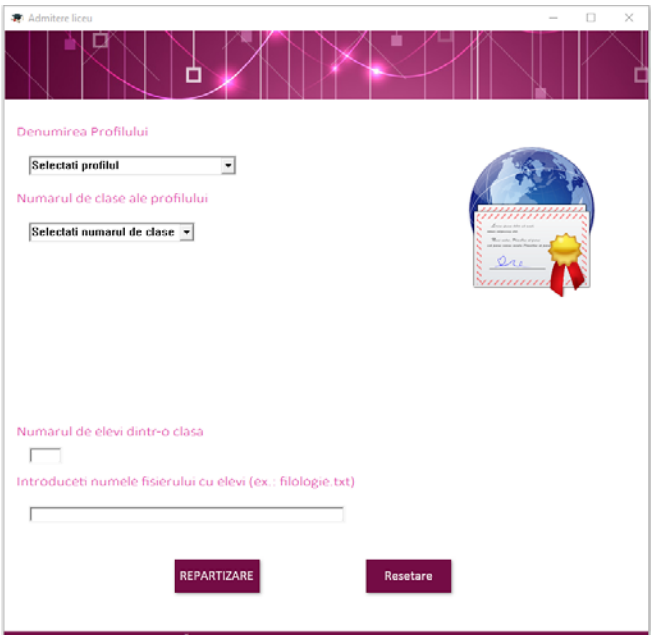
It allows the user to enter the number of classes, the number of places for a class, but also the name of the class master, which will be displayed in the output file.

The application gathers the students' data (name, admission grade and options) and saves in text files the list with the admitted students for each class.

For an efficient implementation, we have used some algorithms for data processing from [9], [10] and [11].

Below are shown screenshots with the visual application.





5. Conclusion

The presented application was developed due to the hard work involved in the profile-based distribution process in high schools where we operate, which was realized until now manually or using spreadsheets.

After building the application, time was saved and the mistakes were avoided. The application interface is simple and easy-to-use.

In the future, we intend to develop a website which let any high school to use this application. The first step in this process was achieved through the web application which allows the use of the C, C++ and Java compilers, [5] and [8].

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A Random Algorithm for Generating Cropping – System Possibilities

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Abstract

The purpose of this paper is to describe a modality of generating the rotation of cultures using a random algorithm. Given a number of cultures, the variants of rotating them within a cropping-system can be numerous, with the mention of respecting some important rules and regulations about common pests and diseases, soil usage etc. This algorithm can be important for those farmers who want to manage better their holdings they have or a useful tool for those who are new in the domain of agriculture. For a better explanation of what we intended to do, a Java implementation of the algorithm was made.

Keywords: random, cropping-system, rotation, crop, agriculture.

1 Introduction

Cropping systems are an extraordinarily simple and powerful instrument for minimizing costs and also increasing profit. The behavior of the cultures with each other and over the soil determines increases in the total production. According to the opinion of authors in paper [12], the cropping-system has a slow action, having influences on a long term over the soil. Also, the cropping system method increases the health status of cultures, the soil fertility and the water management [10]. Their influence is given by the plant rests left on the soil [10] and, as a particular case, of the nitrogen fixed in the soil by the *Leguminosae (vegetables)*, using their particular structure of roots.

Besides other types of methods, such as efficient irrigation [6] and [7], fertilization or the correct appliance of tillage, the cropping-system method has a significant influence over the production and, implicitly, over the results of the agricultural holding. The costs are reduced or at least kept at a fair level, the environment is more protected and the economic indicators improve. The researches made in this direction show that the rational usage of cropping-system has production benefits for the agricultural holding.

2 Advantages of using cropping-system method

Along with the advantages presented in the introduction, the most interesting part of the cropping-systems is that they can give production gains without putting into appliance any other methods. For this gain, the farmer must know the rules of combining cultures in order to maximize the production, which means that he must be very prepared from a scientifically point of view. He must know the pests and diseases for every culture and the consumption of nutritive substances of the culture. We will give an example for the wheat culture in the next rows.

According to the research made for the paper [13], for the wheat culture, we can observe the next values for production:

Table 1. **The effect of the rotation and fertilization over the wheat culture**

Rotation	Culture: wheat					
	N_0P_0		$N_{90}P_{75}$		Manure, 20 t / ha	
	q/ha	**±Δ**	q/ha	±Δ	q/ha	±Δ
Monoculture	**25.9**	**0**	33.2	0	26.9	0
Wheat – Corn	**22.9**	**-3.0**	39.7	+6.5	39.9	+13.0
Peas – Wheat - Corn	**36.1**	**+10.2**	45.1	+11.9	43.5	+16.6
Corn – Sun flower – Wheat – Peas	**28.2**	**+2.3**	49.1	+15.9	42.2	+15.3

The influence of the fertilization is taken out in the first column, emphasized in bold characters, and it can be seen that choosing the right cultures within the cropping-system can increase the production with almost 40% from the wheat monoculture. It can also be deducted that inserting a *Leguminosae (vegetables)* culture increase the soil content in nitrogen and, as a result, the yield is bigger.

3 About random algorithms

A random algorithm is an algorithm that receives as input data random bites which influence the final result or output, besides other input data [2]. For the same input data, a random algorithm outputs different values and it even has a probabilistic execution time. They were derived from genetic algorithms and are connected with probabilities theory.

The random algorithms are studied in more detail in papers [8] and [11]. As shown in them, random algorithms are used in many domains. These domains include the agriculture and the article is the argument for it.

4 Description of the algorithm

We use the next data structures for the algorithm, denoted by:

- Input data:
  - n (integer value) is the number of the cultures taken into consideration
  - m (integer value, m≤n) is the number of the parcels / the number of years / the rotation
  - k (integer value) is the number of solution to be generated
  - a (integer bi-dimensional array) – a[i][j], i≤n, j≤n which contains the values 0 and 1 with the next signification: 0 if the culture i is a pre-emergent for the culture j and 1 otherwise. The bi-dimensional array can be called "the fitting matrix".
- Output data:
  - sol (integer bi-dimensional array) – sol[i][j], i≤k, j≤n, each line being a solution for the cropping-system rotation

As we can see, the algorithm outputs the k solutions which contain the arrangement of the n cultures for the m parcels in which the surface was divided. The cultures will be coded with number from 1 to n and the solutions will be temporarily stored in the x[m] array, then transferred in the array sol.

After generating the solutions, the most profitable cultures will be output, using other types of data.

For the Java implementation, we will use other data structures, besides the ones presented upper, which will facilitate the output for the final user, which may have not algorithm notions. In this matter, the extra data structures will be:

- Input data:
  - cultures[n] (string array) – contains the names of the cultures coded with 1, 2, …, n; every name is associated with the number; for example, if culture[1]='Wheat', the wheat culture is coded with number 1.
  - cost[n] (double array) – cost[i] contains the total costs made for establishing the culture i;
  - price[n] (double array) – price[i] contains the sell price per ton for the culture i;

- production[n] (double array) – production[i] contains the production obtained for the culture i (in tons);

The conditions that the algorithm must verify are:

- a[i][j]=1 (the culture i is a pre-emergent value for the culture j)
- sol[i][1,…,n] ≠ sol[j][1,…,n] (solutions must be different)
- sol[i][j] ≠ sol[i][h] (different values within the same solution; this means monoculture is excluded)

In the next rows we will present the algorithm steps.

Step 1. Read the input data.

Step 2. Generate the solutions in the array x using the random function:

```
nr_sol ← 0
do
    x[0] ← -1
    for i = 1, m do
        do
            x[i] ← 1 + rand() % n
            order values x[1], x[2], …, x[m] ascending
        while  the conditions are not verified
    endfor
    if  x is not equal with every line in sol  then
        nr_sol ← nr_sol + 1
        for i = 1, m do
            sol[nr_sol][i] ← x[i]
        endfor
    endif
while  nr_sol < k
```

Step 3. Output of the k solutions, which means the output of the bi-dimensional array sol.

5 Implementation and results

We will take an example of implementing the algorithm. We used in this matter a Java compiler, in order to find out the results and the execution time.

We will also use the fitting matrix, the bi-dimensional array a[n][n], whose values will be presented in the next table:

Table 2. **The bi-dimensional array for our implementation**

	Wheat	Corn	Barley	Sunflo wer	Colza	Peas	Soy	2-row barley	Beans	Sugar beet
Wheat	0	0	0	1	1	1	1	0	1	1
Corn	1	0	1	0	1	1	0	1	1	1
Barley	0	0	0	1	1	1	0	0	1	0
Sunflower	1	1	1	0	0	1	0	1	0	0
Colza	1	0	1	0	0	1	0	1	0	0
Peas	1	0	1	1	0	0	0	1	0	1
Soy	1	1	1	1	1	0	1	1	0	1
2-row barley	0	1	0	1	1	0	0	0	0	1
Beans	1	1	1	0	0	0	0	1	0	1
Sugar beet	1	0	1	1	0	1	1	1	1	0

We consider an agricultural holding that has a surface of 1 ha. The holding is supposed to be in an area where all ten cultures presented in the table above can be planted, according to the conditions for every culture, related to temperatures, precipitations and soil type. The costs and the production per hectare and the price per kilogram for every production are presented in the next table:

Table 3. **Costs, production and price for the 10 cultures**

	Cost / ha [lei/ha]	Production /ha [kg/ha]	Price [lei/kg]
Wheat	2674.0	3500.0	0.6
Corn	2563.1	4000.0	0.6
Barley	2812.3	4000.0	0.65
Sunflower	2399.9	1800.0	1.1
Colza	2554.4	3000.0	1.3
Peas	3773.5	1600.0	2.0
Soy	2675.4	1800.0	2.3
Two-row barley	2753.0	4000.0	0.65
Beans	3785.1	1600.0	10.0
Sugar beet	4000.0	43000.0	0.15

We also consider that the agricultural surface is divided in 5 (then, m=5) and the number of solutions we want to output is 14 (then, k=14). Given these values, the algorithm generates the solutions shown in the Table 4 (in this table, they were rounded to integer values). After their generation, the incomes are calculated for each solution, using data from Table 3, and then the gross profit by reducing the incomes with the costs. The next formulas were used: $Income = Production * Price$ and $Profit = Income - Costs$. The table 4 is shown here:

Table 4. **Results for the implementation**

Solution	Income	Profit
Two-row-barley - Wheat - Sunflower - Peas - Sugar-beet	16,330.00	729.60
Soy - Wheat - Sunflower - Barley - Colza	14,720.00	1,604.00
Beans - Two-row-barley - Colza - Wheat - Peas	27,800.00	12,260.00
Beans - Barley - Peas - Wheat - Soy	28,040.00	12319.70
Beans - Barley - Sunflower - Peas - Two-row-barley	26,380.00	10,856.20
Two-row-barley - Corn - Barley - Sunflower - Peas	12,780.00	-1,521.80
Two-row-barley - Soy - Colza - Wheat - Beans	28,740.00	14,298.10
Soy - Wheat - Sunflower - Barley - Peas	14,020.00	-315.10
Two-row-barley - Wheat - Colza - Peas - Sugar-beet	18,250.00	2,495.10
Sugar-beet - Barley - Peas - Beans - Corn	30,650.00	13,716.00
Peas - Barley - Colza - Wheat - Sugar-beet	18,250.00	2,435.80
Peas - Corn - Colza - Barley - Sunflower	14,080.00	-23.20
Soy - Wheat - Peas - Sunflower - Corn	13,820.00	-265.90
Sugar-beet - Peas - Sunflower - Barley - Beans	30,230.00	13,459.20

In the table below we can see that the most profitable solution is *Two-row-barley - Soy - Colza - Wheat - Beans,* with a profit of 14,298.10 lei without taking into consideration the subsidy accorded by the national authorities.

A Java implementation of this algorithm is shown in Figure 1.

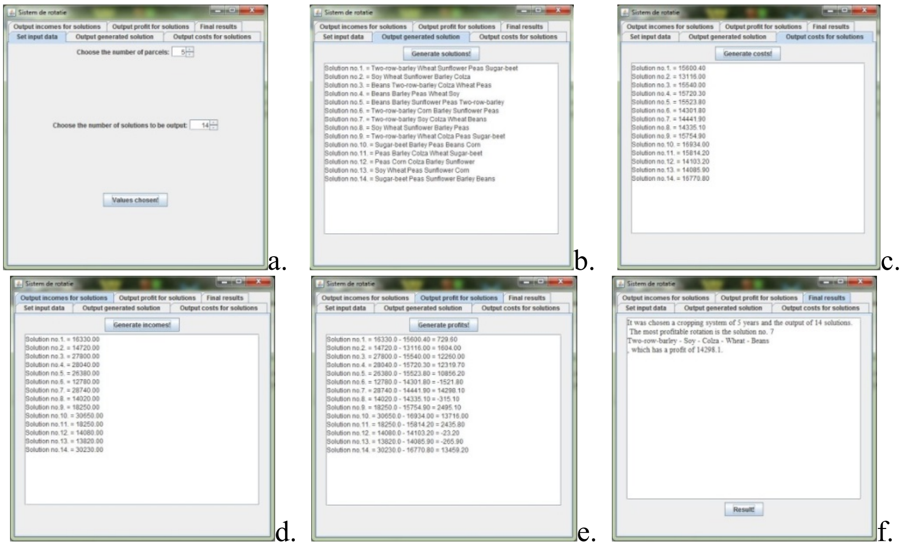

Figure 1. **A Java interface for the algorithm**

Regarding the efficiency of the algorithm, we calculated the execution times for different values of k (the number of generated solutions). The obtained values are presented in Figure 2.

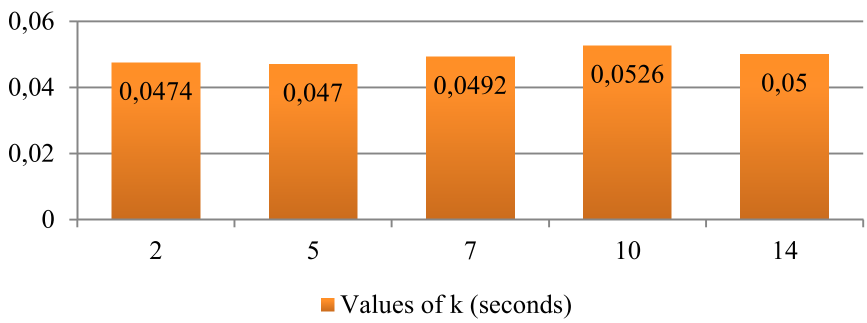

Figure 2. **Execution times for different values of k**

As we can observe, the values are approximately constant. For example, the value obtained for k=100 is 0.047.

Also, the differences between execution times for different values of n when m and k (m=2 and k=2) and in different periods of runtime are constant are presented in the next table:

Table 5. **Execution times for different values of n when m=2 and k=2**

Values of n	I	II	III	IV	V
5	0.046	0.046	0.048	0.046	0.047
6	0.048	0.050	0.050	0.049	0.048
7	0.049	0.049	0.048	0.047	0.048
8	0.049	0.048	0.047	0.045	0.044
9	0.047	0.048	0.048	0.046	0.047
10	0.051	0.046	0.048	0.050	0.049

It can be observed that the execution times are comprised between 0.044 and 0.051 seconds.

6 Comparison with the backtracking algorithm

A backtracking method of generating the solutions of a cropping-system is another way of generating solutions for cropping-systems. The method of backtracking and generation of permutations are studied in detail in papers [1], [4], [3] and [5]. Here we will analyze the differences between this method and backtracking method.

In the next table, we will present some differences between the backtracking method and the random method.

Table 6. **Differences for various parameters**

Parameter \ Method	Backtracking method	Random method
Runtime	Increases exponentially as the value n grows	Is approximately constant whether n or k is modified (has a polynomial runtime)
Utility	Shows exactly which culture is most profitable	May miss the most profitable culture
Type of solutions	The solutions are the same for different periods of compilation	The solutions are probabilistic and modify in different periods of compilation
Number of solutions (k)	Is fixed by the program	It is established by the user

The differences presented in the Table 6 show that the random algorithm is better and more efficient on the resources consumption part. The particular output of solutions for the random algorithm makes the backtracking method more accurate. On the other hand, the solutions are more numerous for the random method and their number is set by the user, for higher values of k being faster than the backtracking algorithm (has a polynomial runtime, while the backtracking has an exponential one).

The values obtained show that backtracking method is more efficient, but for moderate values. For example, for n=10 and m=5, the backtracking method breaks because of the long exponential runtime, while the random algorithm works very smooth, as shown in Table 5.

7 Conclusion

We can observe that the cropping-system method applied in the agricultural process brings advantages, including the protection of the environment. The methods of obtaining the possibilities for rotation of cultures (the random and backtracking method with their advantages and disadvantages) show us that we have the potential to find the best solutions for the holding. The accuracy of the results depend in a great deal on "the fitting matrix" and, because this fact, a future analysis of this problem would bring more precise results for a farmer and, thus, a greater efficiency for the holding.

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Cloud hybrid service for monitoring building energy efficiency obtained by using insulation structures

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Abstract

The paper present the model based on smart sensors network system for building efficiency monitoring based on machine to machine (M2M) technologies. The system is based on temperature sensors, a mainboard, a transceiver and a power source. The sensors are integrated in experimental model for receiving and send wireless data. The data storage is made on cloud (PaaS) and the users may access data by using a web based interface (SaaS). Cloud computing and grid computing are oriented in sharing distributed resources in a network environment and this allow a large number of users to send and receive information. The resources shared are systems like CPUs, storage, data, and memory. By using cloud computing is possible to storage data received from sensors, analyze data and provide charts. Data from cloud computing services (PaaS) can be used in IoT projects.

Keywords: Cloud computing, M2M, monitoring, sensors, building

1 Introduction

For this application was used a hybrid cloud because the service is based on composition between private and public cloud. The private cloud should maintain a high services availability by using provisioned resources from a public cloud when are workload fluctuations or hardware failures. In the hybrid cloud are saved critical data and applications and in public cloud are hosted the less critical ones (Jeffrey et al., 2010). The hybrid cloud has the advantage of outsourcing data security responsibility (Garber et al, 2013). The "Internet of Things" application and API are made to store and retrieve data from electronic devices using HTTP over the Internet or via a LAN (Doukas and Maglogiannis, 2011). By using cloud service users can create sensor-logging applications, location tracking applications, and a social network of things. The IoT ThingSpeak API allows numeric data processing such as time scaling, averaging, median, summing, rounding and displaying into a histogram (Doukas and Maglogiannis, 2011).

M2M (Machine-to-Machine) concept represent the modeling of entities connected to "the network" (wireless, by using private or public cloud). The network interconnection of the gadgets (actuators or sensors) is called also "Internet of Things" (IoT), "Internet of Objects" or M2M. Initially M2M concept refered to a large number of devices working together. M2M leads to insurance of safety and comfort by optimization of devices usage for efficient data tracking (Boswarthick et al., 2012).

The objective of M2M is to establish the conditions which allow the possibility for device to exchange information with a application by using wirelles network. The device can be in this case a central unit which analyze the data from all sensors mounted and establish, based on algorithm, when a device (like clima system) can starts (figure 1). Can say about sensors for clima monitoring and software application that are in M2M relationship. M2M is short synonim for M2M communications (M2(CN2)M: Machine-to-(Communication-Network-to-)Machine) (Boswarthick et al., 2012).

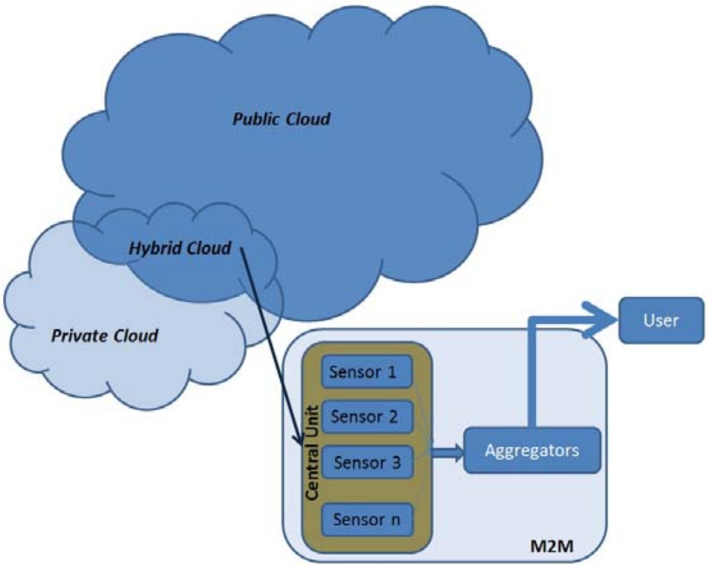

Figure 1. **Hybrid cloud & M2M model**

1 Math modeling

For solving the problem of building energy efficiency in case of using of the insulation layer (for flat walls) were considered these simplifying assumptions :

-the wall is composed of three layers (outer wall, insulating layer and inner wall) (Aileni, 2014)

-the layers have known thickness

-each layer has a uniform composition

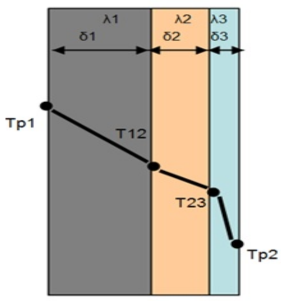

Figure 2. **Flat wall composed of three layers (Aileni, 2014)**

The equations used are:

-for first layer (1)

$$Q = \frac{\lambda_1}{\delta_1} A(T_{p1} - T_{12}) \quad (1)$$

-for second layer (2)

$$Q = \frac{\lambda_2}{\delta_2} A(T_{12} - T_{23}) \quad (2)$$

-for third layer (3)

$$Q = \frac{\lambda_3}{\delta_3} A(T_{23} - T_{p2}) \tag{3}$$

By adding relations 1, 2 and 3 it results the equation 4:

$$T_{p1} - T_{p2} = \frac{Q}{A} \cdot \left(\frac{\delta_1}{\lambda_1} + \frac{\delta_2}{\lambda_2} + \frac{\delta_3}{\lambda_3} \right) \tag{4}$$

And this means that value for thermal flow is obtained by relation 5:

$$Q = \frac{A(T_{p1} - T_{p2})}{\frac{\delta_1}{\lambda_1} + \frac{\delta_2}{\lambda_2} + \frac{\delta_3}{\lambda_3}} \tag{5}$$

By generalizing results the expression 6 for thermal flow:

$$Q = \frac{A(T_{p1} - T_{p2})}{\sum_{i=1}^{n} \frac{\delta_i}{\lambda_i}} = \frac{A \Delta T}{\sum_{i=1}^{n} \frac{\delta_i}{\lambda_i}} \tag{6}$$

Where $\frac{\delta_1}{\lambda_1}$ is thermal resistance for field i and $\sum_{i=1}^{n} \frac{\delta_i}{\lambda_i}$ is thermal resistance of the entire wall.

2 Software development

The software was developed by using VS IDE. In the software Thermon the user can insert data about wall thickness (δ), wall analyzed area, thermal conductivity coefficient (λ) and also can choose active sensors from which will track the required temperature values (figura 3). The user also can view data about temperature values for each sensors selected, can compute the value for thermal flow, can save in database informations and can delete data. The thermal flow value can indicate the energy efficiency provided by building insulation.

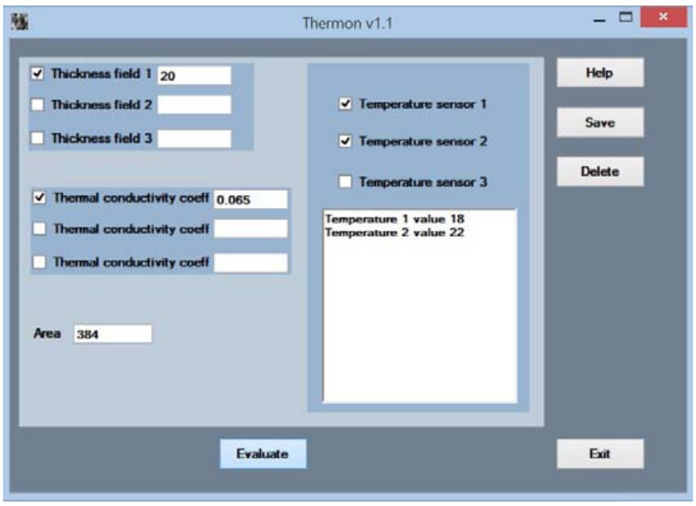

Figure 3. **Thermon software for thermal flow computing**

For cloud computing was used the service Thing Speak. ThingSpeak channels store sent data from temperature sensors to a ThingSpeak channel. For transform and display data sent in a Matlab hystogram by using cloud sevice was necesary to add code in apps for analitics (figure 4). The cloud service allow to transform and visualize data or trigger an action by using apps. Data from temperature sensors data were added on chanels in private mode (figure 5).

new 1.c

```
tempF = thingSpeakRead(readChannelID, 'Fields', TemperatureFieldID, 'NumMinutes', 10*60);
hist(tempC);
xlabel('Temperature (C)');
ylabel('Number of Measurements for each Temperature');
title('Histogram of Temperature variation');
grid on
```

Figure 4. **Code for data display in hystogram**

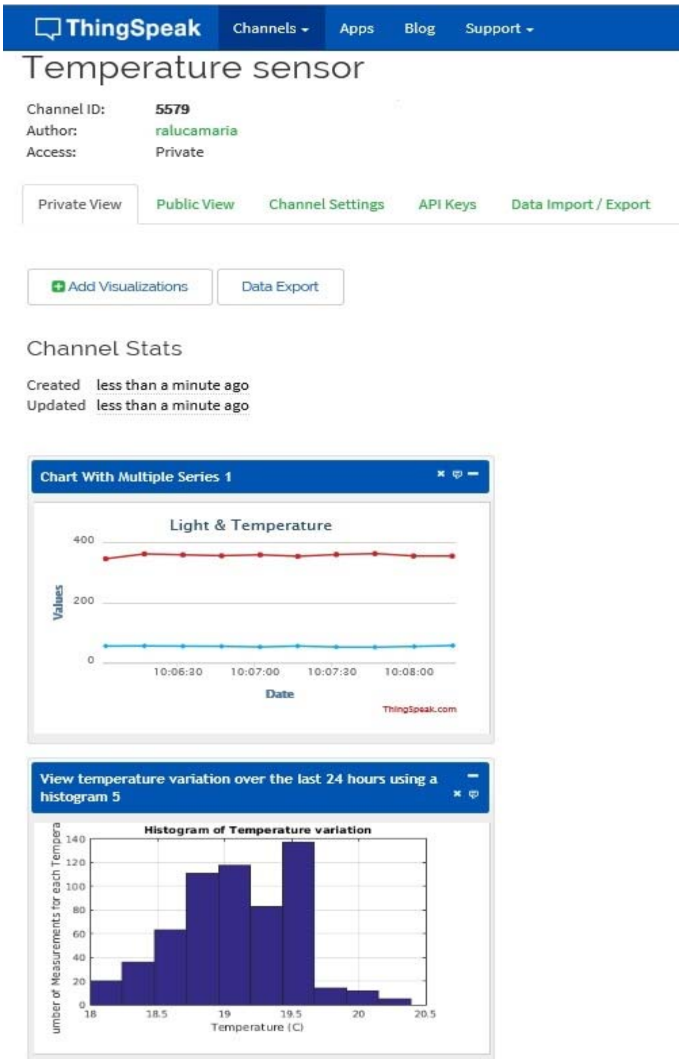

Figure 5. **Channel Temperature sensor - Hystogram - Temperature variation**

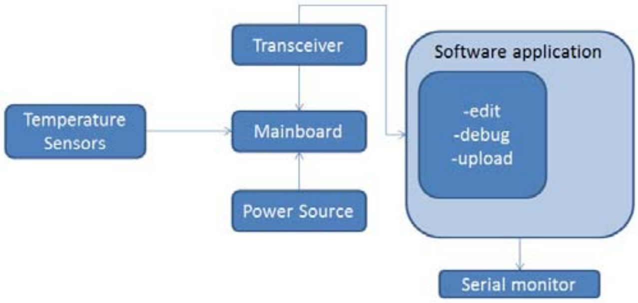

Figure 3. **Software application schema**

3 Conclusions

The software application is usefull in education area and for laboratory tests. The thermal flow value offer details about energy efficiency obtained by building insulation with diferrent materials (with different thermal coefficients).

The usage of cloud service allow storage of the data tracked from sensors and visualization by using different Matlab histograms.

The sensors data storage in the cloud provides easy access to data and offer, by online analytical tools, the possibility to explore, analyze and visualize data.

The storage of temperature values from sensors in cloud is better that storage in local database because bigdata can produce data overload.

The sensors for clima monitoring and software application Thermon are in M2M relationship.

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Expert system Smartex based on artificial intelligence for analyze data tracked from medical sensors

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Abstract

The paper presents software application Smartex which offer solution based on artificial intelligence for analyzing data obtained from medical sensors. The Smartex application collects data from hardware system composed by temperature sensor, mainboard and a Bluetooth device. The mainboard was initialized by using a software application which allows reading data from sensor after calibration. The software application allows parsing the sensor data received and storage into a database. Also the program for predictive evaluation has the ability, based on matching algorithm use, to choose a correct answer from knowledge base regarding medical conditions related to the range of values collected from sensors.

Keywords: sensors, temperature, predictive, artificial intelligence

1 Introduction

The predictive systems are based on computer modeling and develop decision support systems (DSS) for professionals and individual users (Sauter, 2010). The DSS analyzes data (patient, clinical, biological, therapeutic, behavioral, environmental or occupational exposure, physical training and performance, lifestyle and diet, environmental data, social data etc.) and present the results for make decisions easier (Greenes, 2007). The predictive models interconnected can process these data in real-time and can predict how the health of the patient will evolve in the near future.

DSS may also help to improve interactions between individuals / health professionals and co-decision making in healthcare actions (Sauter, 2010).

The Smartex has a part of knowledge DSS which provides specialized problem-solving expertise stored as facts, rules, procedures.

DSS components may be classified as:

- Inputs: data from sensors;
- User Knowledge and Expertise: Inputs about diseases associated (rules)
- Outputs: Data processed
- Decisions: Results generated by the DSS based on user medical data

Electronic health records (EHRs) is the first step in capturing and utilizing health data and the second is to turn data into useful information. EHRs achieved 70–72% accuracy in predicting individualized treatment response. Clinical DSS can be modelled as a form of artificial intelligence embedded within clinical systems

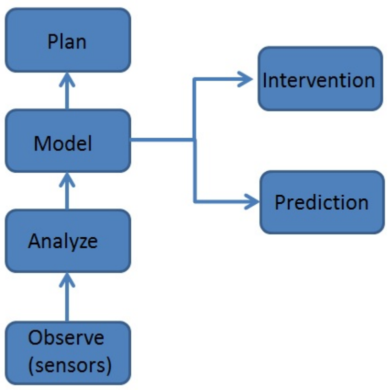

Figure 1. **Predictive model schema**

(Bennett et al., 2012). For intervention and predictive model in health (figure 1) are necessary previous steps: observing patient (data from sensors), analysing data, modeling data and reducing the outliers values, plan the intervention and predictive modeling (Szolovits, 2010).

2 Software development

For modeling the DSS it was used a bipartite graph with probabilities (Goel et. Al., 2010, Parveen et al. 2015, Zadelho, 2013), where was applied the Bayes' rule to compute the probabilities of each of the Di - disease after having observed any of the Sj -symptoms (figure 2).

For each symptom like fever they have been associated the intervals for temperature and humidity at the body level.

The Smartex application track data from biomedical sensors and parse data into database. The hardware system is composed by temperature sensor, humidity sensor, mainboard and a Bluetooth device. The software has a module for predictive evaluation based on matching algorithm which use data about patient health state, a database of symptoms associated with each disease and rules for choosing the correct answer from knowledge base regarding medical conditions related to the data included in the range of values tracked from sensors. For classification the data and correlation with disease type was used fuzzy clustering algorithm (Fuzzy C-Means).

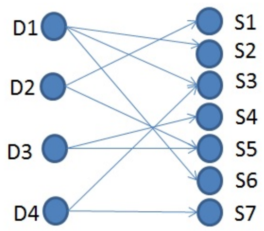

Figure 2. **Bipartite graph with probabilities Di (diseases) and S_i (symptomas)**

The Fuzzy C-Means algorithm partition a finite collection of n elements $X=\{x_1, x_2,...,x_n\}$ into a collection of c fuzzy clusters (Cho et al., 2014). The algoritm returns a list of c cluster centres $C=\{c_1,c_2,...,c_m\}$ and a partition matrix $W=w_{i,j} \in [0,1]$, $i = \overline{1,n}, j = \overline{1,m}$. The elements from partition matrix tell the degree to which $x_i \in$ to cluster c_j.

The software application contain a login interface (for patients, doctors –figure 3). The application offer possibility to save data tracked from biosensors and to view data. The doctor can use predictive model for evaluate the patient health state and to find the right disease associated with patients symptoms (figure 3).

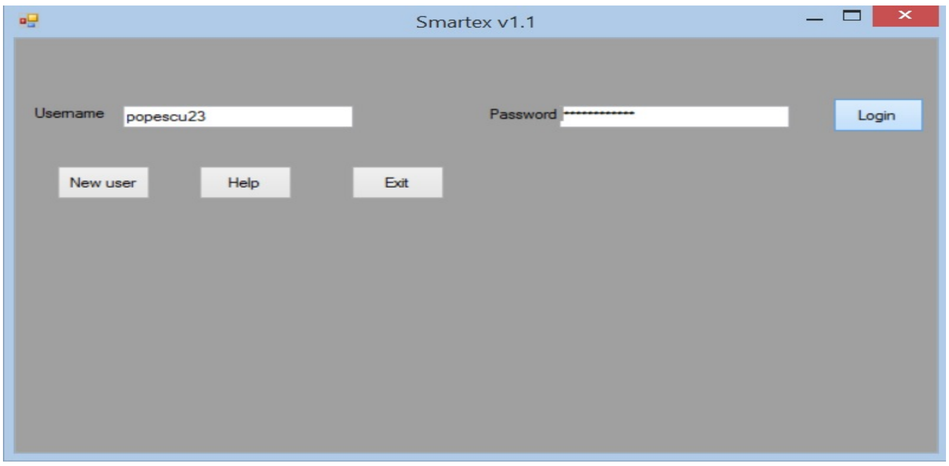

Figure 3. **Login interface**

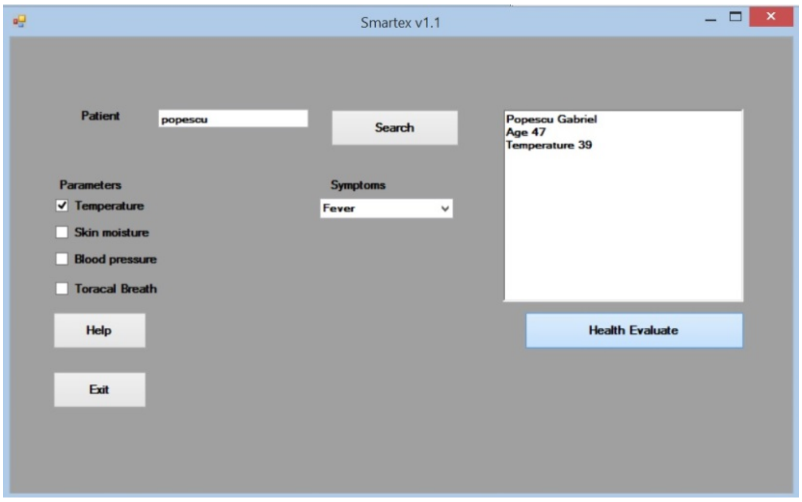

Figure 4. **Smartex software –Main (patient search, data view and patient profile evaluation =f(symptoms))**

3 Conclusions

The decision system support help in increasing the interactions between health professionals and co-decision making in healthcare actions.

The predictive model allow a quick mapping of past symptoms with the possible diseases in future.

The application is useful for students which learn evaluate and to correlate the symptomas with diseases.

The analyzed data about patients (clinical, biological, therapeutic) can be correlated with environmental and occupational exposure, physical training and performance, lifestyle and diet for find the cause and the patterns for diseases, present the results and make right decision.

By using predictive models patients and doctors should have information about the future course and the risk for diseases (Waljee et al., 2014).

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Virtual Instrument for the Study of the Signals Generating

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Abstract

This paper aims to achieve a virtual instrument, developed around NI myDAQ of National Instruments Company, for the study of the signals generating. Virtual instrument have been developed by using LabVIEW graphical language programming. This virtual instrument will assist students who will conduct laboratory at Virtual Instrumentation discipline and will generate several waves: sinusoidal, triangle, square and sawtooth. These signals will be generated at AO 0 analog output channel of DAQ device.

Keywords: Virtual instrument, LabVIEW, NI myDAQ, Front Panel, Block Diagram

1 Introduction

In the past 20 years, measuring systems have experienced a radical change, a revolution, in which the computer has the leading role. In more than 20 years ago, serial communications (RS-232 and GPIB) enabled computer for the first time to become a part of measuring systems (http://www.energ.pub.ro/).

By using the computer as a central "controller" for all instruments of measuring system, they were able to integrate and coordinate multiple measurement instruments in a single system.

Signal generators are electric devices that are used as time variable voltage sources with a specified waveform and adjustable amplitude and frequency. These instruments are used in electrical laboratory in controlling, adjusting or measuring the electrical signals (Rob et al, 2011).

Modular acquisition boards (DAQ) appearance, eliminated the need for coupling to a dedicated processor and memory existence within integrated programs and independent measuring instruments. The advantages of DAQ cards were: computer components have become smaller, decreased costs and increased performance of measuring systems.

National Instruments produce a wide range of DAQ cards, which generally used for acquiring and generating signals. These cards usually have a few numbers of analog inputs/outputs, digital inputs/ouputs, counters and frequency generator with hardware/software timing. Many devices have a test panel for testing specific device functionality, such as the ability to acquire and generate signals.

LabVIEW programs are called virtual instruments, or VIs, because their appearance and operation imitate physical instruments, such as oscilloscopes, multimeters and spectrum analyzer. LabVIEW contains a comprehensive set of tools for acquiring, analyzing, displaying, and storing data, as well as tools to help you troubleshoot code you write. In LabVIEW, you build a user interface, or front panel, with controls and indicators. Controls are knobs, push buttons, dials, and other input mechanisms. Indicators are graphs, LEDs, and other output displays. After you build the user interface, you add code using VIs and structures to control the front panel objects. The block diagram contains this code (http://www.ni.com/pdf/labview/us/getting_started_820.pdf).

2 The Signal Generator VI

Using NI myDAQ device, acquired from National Instruments, we have created a virtual instrument for generating different types of signals (sine, rectangle, triangle, and sawtooth) as well as the possibility of displaying such signals in a graphics indicator.

The application is realized in LabVIEW because this programming environment offers a very attractive interface with the user.

NI myDAQ is a data acquisition device, low-cost, focused on students, who together with LabVIEW graphical programming, enables the measurement, generation and signals analysis from the real world. NI myDAQ combines hardware with eight ready-to-run software-defined instruments, including a function generator, oscilloscope, and digital multimeter (DMM); these software instruments are also used on the NI Educational Laboratory Virtual Instrumentation Suite II (NI ELVIS II) hardware platform so the lab experience can be extended to experiments anywhere, anytime. With NI LabVIEW system design software, users can extend the instrument functionality into hundreds of custom applications (http://www.ni.com/mydaq/what-is/).

There are two analog output channels on NI myDAQ. These channels can be configured as either general-purpose voltage output or audio output.

Both channels have a dedicated digital-to-analog converter (DAC), so they can update simultaneously. In general-purpose mode, you can generate up to ±10 V signals. In audio mode, the two channels represent left and right stereo outputs. Analog outputs can be updated at up to 200 kS/s per channel, making them useful for waveform generation.

2.1 The Front Panel of the VI

The Front Panel was conducted by using the controls (inputs) and the indicators (outputs) as follows:

- one control for channel setting;
- two controls for setting minimum and maximum values respectively of the output signal supported by NI myDAQ;
- two control to change the amplitude and the frequency of the generated signal;
- one control for selecting the type of signal generated;
- one boolean STOP control;
- one graphical indicator for displaying the generated signal.

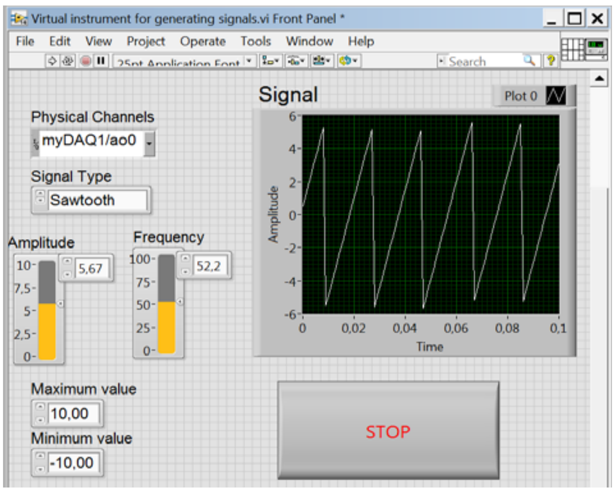

Figure 1. ***Signal Generator Front Panel***

2.2 The Block Diagram of the VI

NI-DAQmx is the next generation drivers for the data acquisition hardware from National Instruments, that has significantly simplified the programming of data acquisition hardware in LabVIEW. NI-DAQmx is a programming interface you can use to communicate with data acquisition devices. Measurement & Automation Explorer (MAX) is a tool automatically installed with NIDAQmx and used to configure National Instruments hardware and software (Bogdan, 2013).

LabVIEW interacts with many kinds of real world hardware. To see what devices are recognized by the computer, go to Start » Programs » National Instruments » Measurement & Automation and then select My System » Devices and Interfaces. Under NIDAQmx Devices section we see all of the devices listed, including NI myDAQ (Bogdan, 2011).

It is easy to use and has many new features such as improved ease of use, faster development time, multithreaded measurements and increased accuracy of measurements. NI-DAQmx can be used to generate analog signals if the data acquisition hardware has the analog output capability. (http://bme.sunysb.edu/labs/wlin/BME313/Project04.pdf). The DAQmx VIs can be found under Functions >>All Functions >> NI Measurements >> DAQmx Data Acquisition.

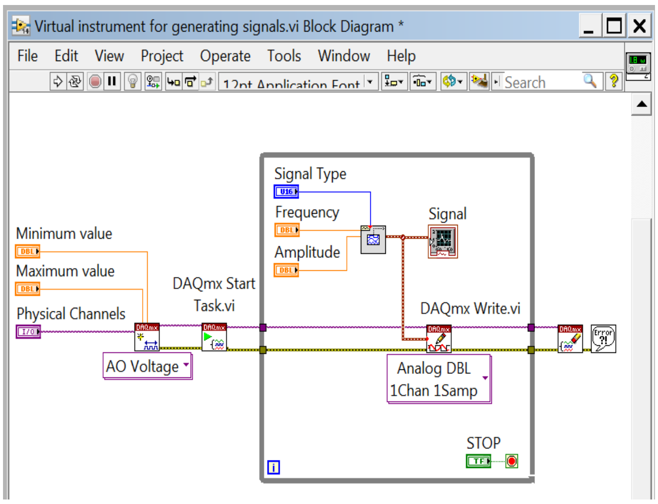

Figure 2. **Signal Generator Block Diagram**

The following are the steps for creating virtual signal generator, block diagram.

a) Create a virtual channel and task using the NI-DAQmx Create Virtual Channel VI. Select Analog output and than voltage.

- **Physical Channels** specifies the names of the physical channels to use to create virtual channels. The DAQmx physical channel constant lists all physical channels on devices and modules installed in the system. You also can wire a string that contains a list or range of physical channels to this input.

- **Maximum value** specifies the maximum value you expect to generate.

- **Minimum value** specifies the minimum value you expect to generate.

b) Create the waveform data for the analog signal generation. I have used Basic Function Generator VI to create the waveform, that creates an output waveform based on signal type.

Signal Type is the type of waveform to generate.

0 Sine Wave (default)

1 Triangle Wave

2 Square Wave
3 Sawtooth Wave

Frequency is the frequency of the waveform in units of hertz.
Amplitude is the amplitude of the waveform. The amplitude is also the peak voltage.

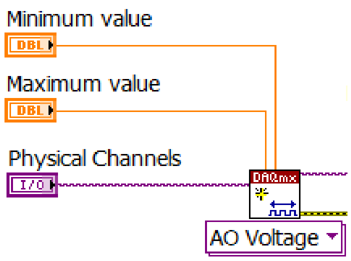

Figure 3. **DAQmx Create Virtual Channel**

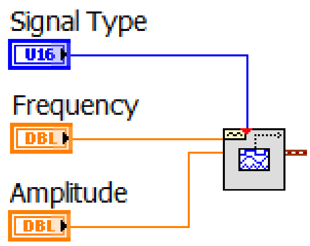

Figure 4. **Basic Function Generator VI**

c) Call the DAQmx Start VI to start the acquisition.
This VI transitions the task to the running state to begin the measurement or generation.
d) Write the waveform data in a loop until the user hits the stop button or an error occurs.

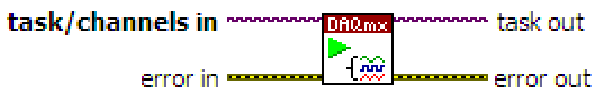

Figure 5. **DAQmx Start Task**

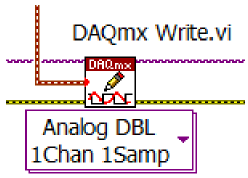

Figure 6. **DAQmx Write VI**

3 Conclusion

Using computers, software, DAQ boards and drivers for these metrics, can be achieved with open architecture (allow further developments), based on the software with user-defined functions. These systems can replace traditional instruments, classical, focusing on hardware and whose functions are defined by the manufacturer.

Virtual instruments based on personal computers (PC), thereby benefiting the performance of these new embedded technologies: the powerful processors, the next-generation operating system, the possibility of interconnecting to the Internet.

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http://bme.sunysb.edu/labs/wlin/BME313/Project04.pdf

Virtual Instrument for the Study of the Signals Sampling

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Abstract

The personal computer (PC) , combined with the multifunctional data acquisition boards (DAQ) and powerful and flexible software, can create sophisticated virtual instruments. This paper aims to achieve a virtual instrument, for the study of the sampling and aliasing signals. Virtual instrument have been developed by using LabVIEW graphical programming. This virtual instrument will assist students who will conduct laboratory at Virtual Instrumentation discipline and will be used for the study of real-world signals , it will need a DAQ for signal acquisition and in simulation mode if the user does not have an DAQ device.

Keywords: Sampling, Aliasing, Virtual instrument, DAQmx, Front Panel, Block Diagram

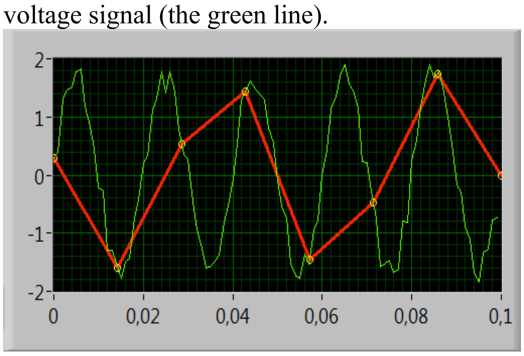
1 Introduction

The analysis of real world signals is a fundamental problem for many engineers and scientists, especially for electrical engineers since almost every real world signal is changed into electrical signals (http://cp.literature.agilent.com/litweb/pdf/5952-8898E.pdf)

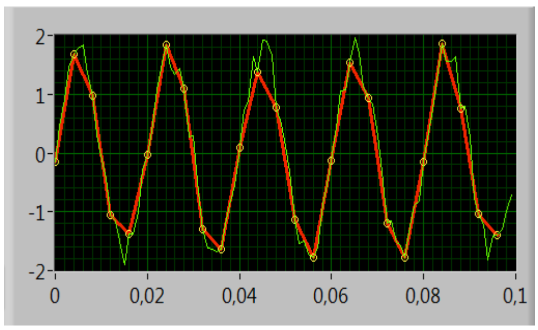
Sampling is the process of converting an input from a continuous form to a discrete form. In reference to instrumentation this generally means converting analog input (which is continuous in nature) and converting it to digital form (which is discrete in nature). But adequate number of samples must be taken from a given analog signal in order to effectively reconstruct it back from its samples. The 'adequate' number of samples needed is determined by the Nyquist-Shannon theorem. The theorem states that the perfect reconstruction of an analog signal is possible when the sampling frequency is greater than twice the maximum frequency of the signal being sampled (Bogdan, 2009).

Aliasing is the appearance of phantom frequencies when a signal is not sampled at a high enough rate. In films (which are normally sampled at 24 frames per second) you can often see the wheels of cars or stagecoaches slow down, stand still, or even appear to rotate backwards. This is aliasing (http://zone.ni.com/devzone/cda/tut/p/id/3016).

Consider the two examples shown in the figure below, which show two sets of samples (marked by the yellow points) of a continuous voltage signal (the green line).



(a)



(b)

Figure 1. **Sampling at fs < 2f (a) and sampling at fs > 2f (b)**

In Figure 1 (a) the sampling rate is too low, and the measured points define a waveform that appears quite different than the original signal (even though each individual sample is accurately measured). In Figuree 1 (b) the sampling frequency (the number of samples taken per second) appears to be enough to define all the important features of the signal. This problem is referred to as aliasing, and we would say that in case (a) the 'signal is aliased'. Note that aliasing causes errors whenever we want to use the samples to determine something about the time sequence itself, such as the frequency content of the signal. It doesn't cause errors in statistics, like the mean or standard deviation as long as a sufficient number of samples are taken. So how fast do we have to sample to avoid aliasing? The answer is that we have to sample at a rate that is at least twice the highest frequency in the signal. This important condition is referred to as the Nyquist Criterion. The frequency that is half the sampling rate (i.e. the maximum permissible frequency in the signal if we are to avoid aliasing) is referred to as the Nyquist Frequency (http://www.dept.aoe.vt.edu/ ~aborgolt/aoe3054/manual/ inst3/index.html).

2 The Signals Sampling VI

Using NI myDAQ device , acquired from National Instruments, we have created a virtual instrument for the study of the signals sampling and aliasing. This virtual instrument will be used for the study of real-world signals, when you will need to purchase a DAQ device and in simulation mode if the user does not have an DAQ device.

2.1 The Front Panel of the VI

The Front Panel is the graphical user interface Via of the Front Panel items, the application receives input data and then displays the output that resulted from running.

The Front panel contains a number of controls and indicators , as follows:

- one graph indicator (Waveform Graph) called Time Domain Signals, which displays two signals in the time domain: the Original Signal (green) and the Sampling Signal (red) This graph has as parameters on the X axis, the time (s) and the Y-axis the amplitude (V);
- one graph indicator (Waveform Graph) called Frequency Domain Signals, which displays the frequency spectrum of the two signals;
-one numeric control (Pointer Slide) called the Sampling Frequency , of which changes the sampling frequency;
- two control to change the amplitude and the frequency of the simulated signal;
- one Boolean control, called Measurement / Simulation, by which virtual instrument will operate under Measurement (real signal obtained through the NI myDAQ device) and under Simulation (signal simulated obtained from the VI Simulate Signal);
- one boolean STOP control;

2.2 The Block Diagram of the VI

Once you have established the elements and the front panel layout (with different decorative elements) we have passed the stage of "programming", building Block Diagram. With "fixation" on the Front Panel, of the control and indicator elements, in the Block Diagram appear automatically their terminals. Terminals are entry and exit ports that exchange information between the front panel and block diagram. Block diagram objects include terminals, subVIs, functions, constants, structures, and wires that transfer data among other block diagram objects.

The figure below is the Block Diagram of the Signals Sampling VI, done.

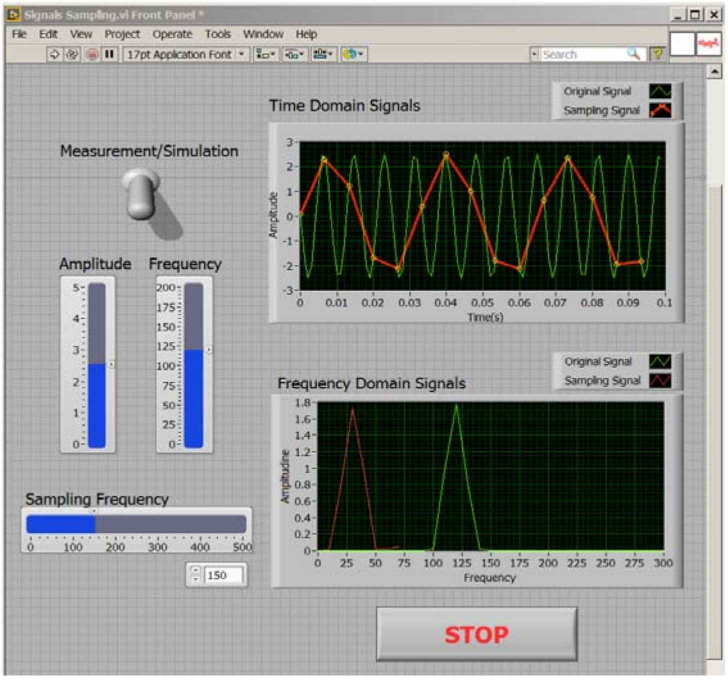


Figure 2. **Signals Sampling Front Panel**

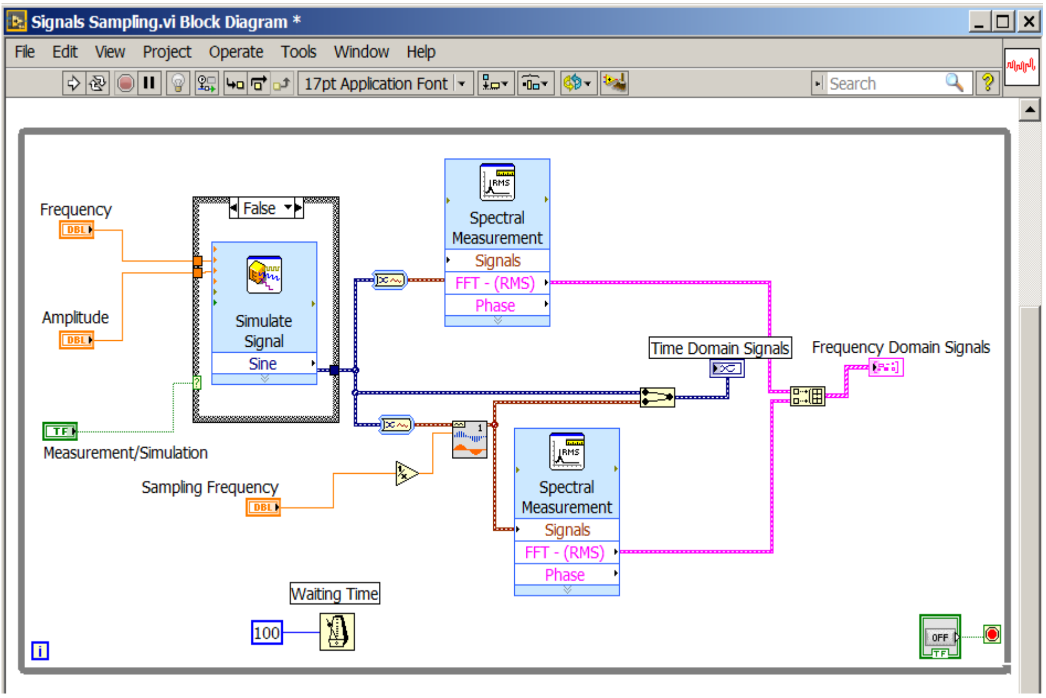


Figure 3. **Signals Sampling Block Diagram**

In making the Block Diagram, we used four Express virtual instruments:

- the Simulate Signal Express VI, to simulate different waveforms with their parameter setting (Functions>Express > Signal Analysis > Simulate Signals);

- the DAQ Assistant Express VI to acquire the voltage signal (Functions> Express> Input>DAQ Assistant). We set the maximum voltage (±10V) acquisition mode (N Samples) , the number of samples to read (100) and the sampling frequency (1kHz);

- two Spectral Measurements Express VIs, determining the power spectrum of the original signal and the sampled signal respectively (Functions>Express>Signal Analysis> Spectral Measurements).

To obtain the sampling interval necessary for the application to the entry of Resample Waveform function, the sampling frequency entered in the front panel control is applied to the entry of Reciprocal function.

To display both power spectrum on the same chart, we used at the input terminal of the Frequency Domain Signals graph, the Build Array function.

The Block Diagram contains a Case structure with two windows. By selecting the True window of the Boolean switch Measurement / Simulation, will work in the

Measuring mode (with real and signal acquisition board). By selecting the False window of the Boolean switch Measurement / Simulation, will work in the Simulation mode (with simulated signal without the need DAQ device).

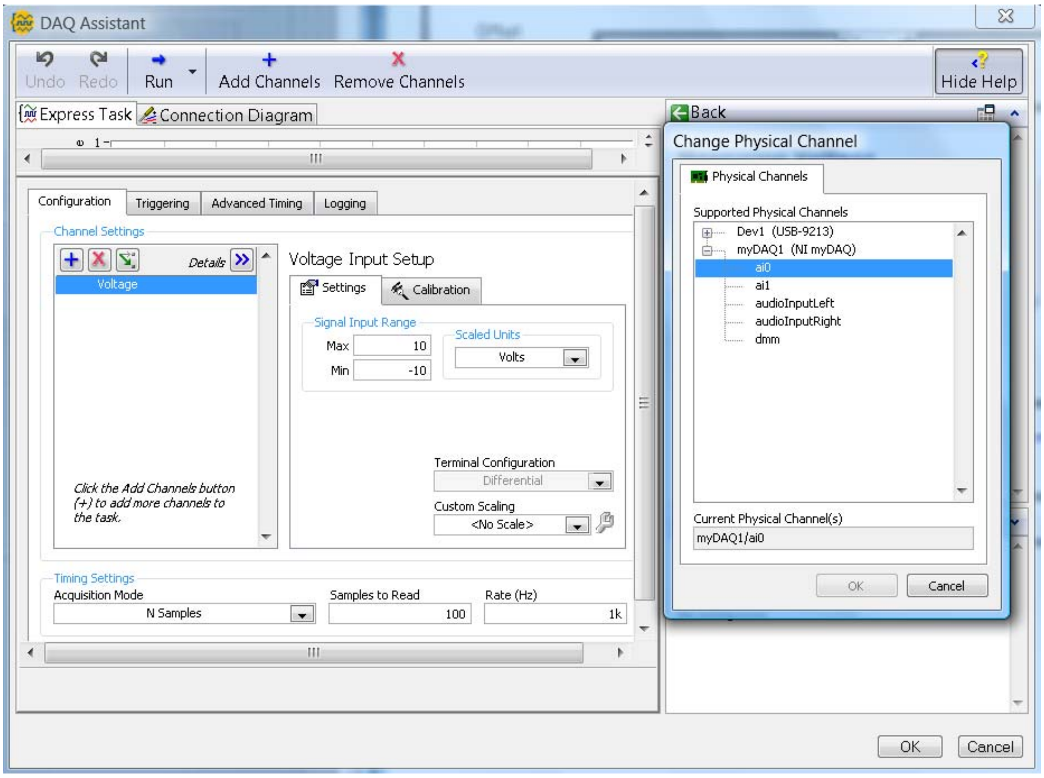


Figure 4. **Configure the DAQ Assistant**

3 Conclusion

NI LabVIEW is an open environment designed to make interfacing with any measurement hardware simple. It combines data acquisition, analysis, and presentation tools into one software program. With interactive assistants, code generation, and connectivity to thousands of devices, LabVIEW makes gathering data as simple as possible.

This paper aims to achieve a virtual instrument, for the study of the sampling and aliasing signals. Virtual instrument have been developed by using LabVIEW graphical programming. This virtual instrument will assist students who will conduct laboratory at Virtual Instrumentation discipline

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A Continuous Development Strategy for a Higher Education Virtual Campus

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Abstract

The Learning analytics offers higher education valuable insights that can inform strategic decision-making regarding resource allocation for educational excellence. Research demonstrates that virtual campus learning management systems (LMSs) can increase student sense of community, support learning communities and enhance student engagement and success, and LMSs have therefore become core enterprise component in many universities. We started the development of our new university virtual campus CVUPT in 2008 as a continuing activity based on new technological developments but also on the new learning analytics tools integrated in the LMS. A our university is a research-intensive university, we used data to inform and guide an LMS review and strategic development process. Using a new learning analytics tools we prepared a continuous preview based in the last 4 academic years. This paper presents the data from this analysis and comments on what it reveals about the comparative effectiveness of this institution's LMS integration in the service of learning and teaching.

Keywords: Education, Educational Software, Software Systems, Technologies

1 Introduction

In order to evaluate learning analytics techniques and model scenarios for use, we had to construct a dataset of real data in machine optimal format. The source for this dataset is the Virtual Campus platform (CVUPT), the eLearning solution used in the Politehnica University Timisoara. Before the construction of the data set, the collected data must be evaluated in terms of quality, quantity, storage format, and relevance to the following steps in our study. In the proposed test scenario, we must collect a large amount of information about users (their interaction with the platform, academic history, demographics, roles on the platform, etc.), educational objects with which they interact, course structures, etc. To achieve predictions it is necessary for the dataset to contain information collected from several successive academic years.

CVUPT was developed on top of the open-source learning management system Moodle. At the moment, the last four academic years are available for analysis. At the beginning of each academic year, the platform is updated to the latest official Moodle version, which sometimes implies changing the structure of the collected information. Due to these periodic changes, it is necessary to find an appropriate common data structure for converting the different data formats.

We will present next a comparison of the four existing instances of the CVUPT platform, corresponding to the academic years: 2010-2011, 2011-2012, 2012-2013 and 2013-2014. We will identify the relevant data according to the aforementioned scenario, the structures in which they are kept, as well as the differences between the four years of study by correlating the data of the platform's instances.

Table 1. **Courses and user accounts in the four platform instances**

	CV 2010 - 2011	CV 2011 – 2012	CV 2012 - 2013	CV 2013 - 2014
Moodle Version	1.9.9+	2.1.x	2.2.x	2.5.x
Total courses	577	773	878	1267
Distance Learning courses	108	109	110	163
Master's courses	436	537	552	866
Undergraduate courses	8	17	31	45
Total user accounts	2906	4846	6332	10206
Number of students	2568	3694	3664	6342
Number of tutors	262	378	427	575

2 Courses and users

Table 1 presents the quantitative evolution of the CVUPT platform starting with the 2010-2011 academic year, up until the current complete academic year, from the point of view of courses (for different study programs) and user roles (students and tutors).There is a clear yearly increase of courses for each category (Figure 1). This is largely due to the official UPT policy of encouraging the presence on the platform of all master's programs in the university, the deployment of new distance learning and reduced frequency programs, as well as the tutors' willingness to use CVUPT as a support for undergraduate courses, in blended learning mode. Proportionally to the increase in courses, we can see a surge in user accounts on the platform (Figure 2). The difference observed between the sum of student and tutor accounts and the total number of users on the platform is due to: administrative accounts, the usage of the platform as a support for national and European projects (whose users have no other role on the platform), as well as alumni who have no more access to current courses. The last category represents the main factor in this discrepancy. In using the data from CVUPT for analysis, particular care was taken in correctly identifying the courses and the users across the platform's instances. This was done by using the unique identifier for the courses in the databases (the primary key), and the username or unique identifier for the users. For this mechanism to be valid, it is essential that the unique identifier (which is auto-incremented on record insertion) is not reset from one instance to the next. The upgrade from one version to the next is done by using the official Moodle update procedure on top of the existing instance, with the initial database, adapted for the new Moodle version. This way, all the existing users and courses remain unchanged. For the beginning of the new year, the courses are then reset, activity data is erased and new user enrollments are made. This means that all the activities of the previous year are effectively lost. Thus, it is necessary to keep a different instance of the platform for each academic year, an effective "snapshot" of all the existing courses and users.

Figure 1. **The yearly evolution of courses by study program**

3 Educational Tools

Another relevant source of information for the learning analytics scenarios we have implemented is the users' interaction with the educational objects and activities available in courses. Table 2 presents the number of instances for each tool available in the four years of study. The tools available in Moodle can be sorted into two categories: activities (allowing communication, evaluation and the execution of complex pedagogical processes) and resources (tools for distribution of educational materials in a structured form, such as documents).

Table 2. **The number of instances for Activities and Resources during the four years of study**

<table>
<tr><th></th><th>CV 2010 – 2011</th><th>CV 2011 – 2012</th><th>CV 2012 – 2013</th><th>CV 2013 – 2014</th></tr>
<tr><td>Activities</td><td colspan="4"></td></tr>
<tr><td>Assignment</td><td>1138</td><td>1261</td><td>1526</td><td>1936</td></tr>
<tr><td>Attendance</td><td>29</td><td>84</td><td>186</td><td>256</td></tr>
<tr><td>Chat</td><td>17</td><td>8</td><td>42</td><td>52</td></tr>
<tr><td>Choice</td><td>7</td><td>73</td><td>116</td><td>160</td></tr>
<tr><td>Database</td><td></td><td>1</td><td>24</td><td>18</td></tr>
<tr><td>Feedback</td><td></td><td>6</td><td>24</td><td>61</td></tr>
<tr><td>Forum</td><td>633</td><td>812</td><td>955</td><td>1389</td></tr>
<tr><td>Glossary</td><td>16</td><td>25</td><td>50</td><td>73</td></tr>
<tr><td>Lesson</td><td>11</td><td>1</td><td>9</td><td>16</td></tr>
<tr><td>OU blog</td><td>1299</td><td>1282</td><td>1308</td><td>1330</td></tr>
<tr><td>Questionnaire</td><td>25</td><td>50</td><td>84</td><td>238</td></tr>
<tr><td>Quiz</td><td>415</td><td>449</td><td>506</td><td>711</td></tr>
<tr><td>SCORM/AICC</td><td>4</td><td>2</td><td>4</td><td>10</td></tr>
<tr><td>Survey</td><td>5</td><td>4</td><td>2</td><td>9</td></tr>
<tr><td>Wiki</td><td>174</td><td>140</td><td>182</td><td>181</td></tr>
<tr><td>Resources</td><td colspan="4"></td></tr>
<tr><td>Label</td><td>132</td><td>272</td><td>710</td><td>1145</td></tr>
<tr><td>File</td><td rowspan="5">3213*</td><td>2673</td><td>3814</td><td>5924</td></tr>
<tr><td>Folder</td><td>165</td><td>411</td><td>751</td></tr>
<tr><td>URL</td><td>192</td><td>339</td><td>620</td></tr>
<tr><td>Page</td><td>1550</td><td>2828</td><td>4424</td></tr>
<tr><td>IMS content package</td><td>2</td><td>2</td><td>2</td></tr>
</table>

* Moodle 1.9.x has no separate modules for resources

Table 2 and Figure 3 emphasize the fact that the most used activities in CVUPT during the four years are: the assignment, forum, OU blog and the quiz. Assignment-type activities suffered a constant increase in use during the latter years, proving to be a reliable tool. The data collected in concordance with this tool could be used in predicting the academic performance and in alert systems. However, these scenarios require the rest of the data acquired regarding the interaction between users and the platform. The forum is a valuable and well-used communication instrument, and the data acquired by this resource can be used for Social Network Analysis (SNA) techniques. Some of the data from the OU blog activity, especially the comments, can also be used for SNA. In fact, many tools who generate text data (OU blog, wikis, forums, etc.), can be used in certain scenarios of recommendation systems.

Regarding the resources, we can observe from table 2 that for the 2010-2011 academic year, they are not detailed according to type (file, folder, URL, page, IMS). This is due to the fact that the 1.9 version of Moodle does not have different modules for resources, facility introduced by the next major version of the LMS, Moodle 2.0. In order to use the data acquired in relation this instance, further data processing is required. We can also see an increase in the number of resources correlated with the increase in courses. Files and pages observed the biggest growth, since they are the resources that actually contain information, while folders and labels are only used for content management. Of particular interest for this study would be the data pertinent to the users' interaction with these educational objects (for prediction scenarios), and with the information that these resources actually contain (for recommendation systems).

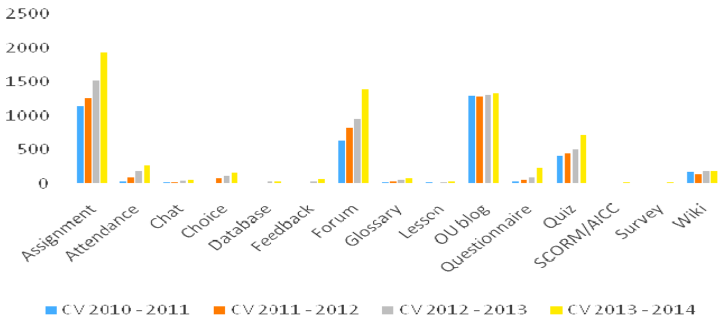

Figure 3. **Yearly records for instances of activity modules.**

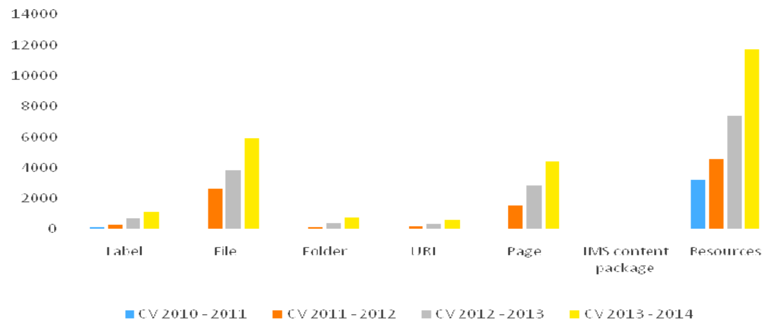

Figure 4. **Yearly records for instances of resource modules.**

4 Logs

User interaction in Moodle, be it the authentication procedure or reading a forum post, is recorded in a centralized structure. This structure is implemented as a relational table in the database and hasn't suffered major changes up until the update for the 2014-2015 academic year. Because we are talking about only one table, and the platform hosts a large number of courses as well as users, this table has millions of records. This is the reason why obtaining real-time statistics will be time-consuming.

For the archived instances of the CVUPT platform, logs can be exported and then processed for relevant data. The current instance needs a specialized procedure which optimizes the access times, while still performing to the desired specifications.

Conclusions

At this stage of the research, we have identified the relevant data collected from the CVUPT educational platform, in the context of the research scenarios. We took into account the usage of different tools available on the platform, in order to prioritize their insertion into the dataset.

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Development and formation aria of transversal computer skills through own designed educational software

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Abstract

There is reporting about ensemble of transversal computer skills able to be developed and forming by the instrumentality of own designed educational software in present article. Described educational software can be applicable in expanded ways in the modern didactical process.

Keywords: Transversal Computer Skills, Educational Software

1 Introduction

The educational process in the information society is absolutely inconceivable outside the concepts of: *digital skills (DS)* and *educational software (ES)*.

According to the European Commission acceptation digital competence (IST - Information Society Technology) is a component of *Common European Reference Framework of Key Competences for Lifelong Learning.*

Predominantly the development and formation of transversal computer skills (TCS) and / or of digital competencies (DC) are performed within computer classes pursuant to curriculum in force and is studied beginning with grade 7-th during of an academic hours (equal with 45 minutes) per week at this moment.

Analyzing the existing typologies of educational software shown at the different authors, in our opinion, now many classes of software dedicated for be using in education could and must be subjected to an ample repartition that respects determining factors of psycho-pedagogical and information-technological order [Burlacu Natalia, 2014].

The problem is that there are not enough suitable ES, designed according to determining factors for its integration into pre-university education, able to develop and form the students' TCS not only in the computer classes.

Ultimate solution for the development and forming of TCS represents the high performance own designed ES these will prepare learners to solve some situations, based on skills and knowledge obtained before, which are evaluated and trained and finally, in the ideal scenario, formed systemically.

2 Description of own conception's ES oriented towards formation of TCS

A good example of a complex interactive multimedia ES corresponding to the level, quality, functionality specified in line with the format of pedagogical-technological development of digital educational products stipulated serves "Digital laboratory specialized to study Romanian language" ("DLSSRL") "(Burlacu Natalia, 2013a; 2013b)" (see Figure 1).

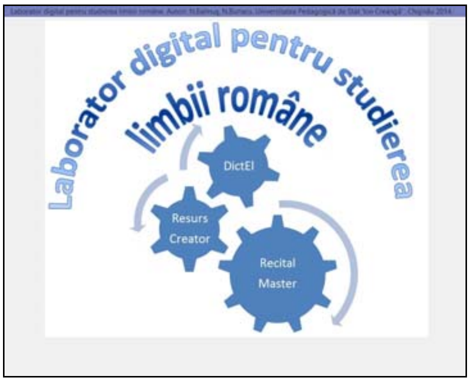

Figure 1. **Presentation's screen of ES**
"Digital laboratory specialized to study Romanian language"

Present ES is focused to linguistic education is devoted, has been developed in programming environment Borland Delphi and is oriented towards formation of TCS.

ES "DLSSRL" surnamed - complex - contains several applications, including:

2.1 Software application "DictEl"

Orthographic methodology of digital laboratory "DictEl" [Burlacu Natalia, 2013a; 2013b; Burlacu and Balmuș, 2014], being amplified by the inclusion of learning the correctly spelled of various analyzers, such as motoric, visual and / or auditive, is presented to be distinct from the traditional technique of making dictation in classroom at the Romanian language lessons. Thus, in case there is a typical dictation scroll thereof imposes certain standard circumstances, such as:

- For the situations when dictations are made at the Romanian language lessons must be found a competent person, more or less, who directly could dictate the text; in the framework of classes, it is the teacher;
- Must well established the place of dictation, here - at the dictation time, is required an absolute silence, allowing discerning the text by students and their focus on exercise (in the school it is happens usually in class of study; normally during the lesson);
- Whatever the circumstances of making the dictation, sooner or later, will be needed the presence of a competent person for evaluating contained;
- In the case of independently training estimating and / or marking objectively, correct of the work is difficult because the probability that the person who has already committed a certain number of errors in a given text will be able to identify own integrated shortcomings in his work - is very low.

Electronic dictation's advantage consists in allows us the luxury not take into account the above mentioned conditions. Such, it is necessary just ES - recipient of the digital laboratory "DictEl", computer on which is installed and, of course, student's desire to know and teacher's desire to modernize educational process. These facts impose continuous execution of some self-initiated efforts to prepare the ground for implementation of new electronic (digital) technologies in the classical training process.

Our application can be used both by the Romanian language teacher during classes and independently by students outside the educational institution.

Implementation of digital laboratory "DictEl" by the teacher lets to organize the lessons in another format than the traditional one; offers an adaptive-individual realization of educational goals; optimizes dictations' control, greatly reducing verification time and excluding subjective processing and marking of works results.

Individual apply of digital laboratory "DictEl" enables fully adapt the dictation's content to each student, apart, from his class's contingent, depending on the theme and objectives, excluding, in case of necessity, students' opportunity to copy from each other. Teacher manages program resources at the lesson, giving oral indications to students about the fact how to access educational software and / or, anew, selecting in advance didactical source - the text of dictation, it being different absolute or relative at the student and / or group of students to another student and / or group of students. The hearing of electronic dictation by students will be done through headphones. Such, now we can create absolutely individual conditions of time and way of performing the work for all control group representatives.

In case of using our software in an independently regime, as training tools for studying spelling and punctuation of the Romanian language after hours in any computer classroom or at home, decades the need to assist, help, examine and / or mark student prompt by the teacher.

2.2 Software application "RecitalMaster"

In during of studying the integrated course of Romanian language and literature the expressive reading holds a major importance. At the hours of modules study of Romanian language and literature is performed expressive reading of three types: teacher's expressive reading, learner's expressive reading and artistic reading of masters of the word in audio records. One crucial importance is the teacher's reading. The teacher cannot teach an art which does not possess. The reasoning goes for the expressive reading art of literary work, whether it's prose or poetry, epic or lyric text [Burlacu Natalia, 2013a; 2013b; Burlacu and Balmuş, 2014].

Methodological delimitation of expressive reading's (ER) learning caused us to study given educational activity in three ways: *(1) Expressive Reading - art in schools; (2) Teacher's Expressive Reading; (3) Student's Expressive Reading.*

So, our educational software for learning expressive reading works in three modes:

Module 1 - Hearing of the model source file;

Module 2 - Recording by user text for ER in an audio file (see Figure 2);

Module 3 - Saving the audio recording results.

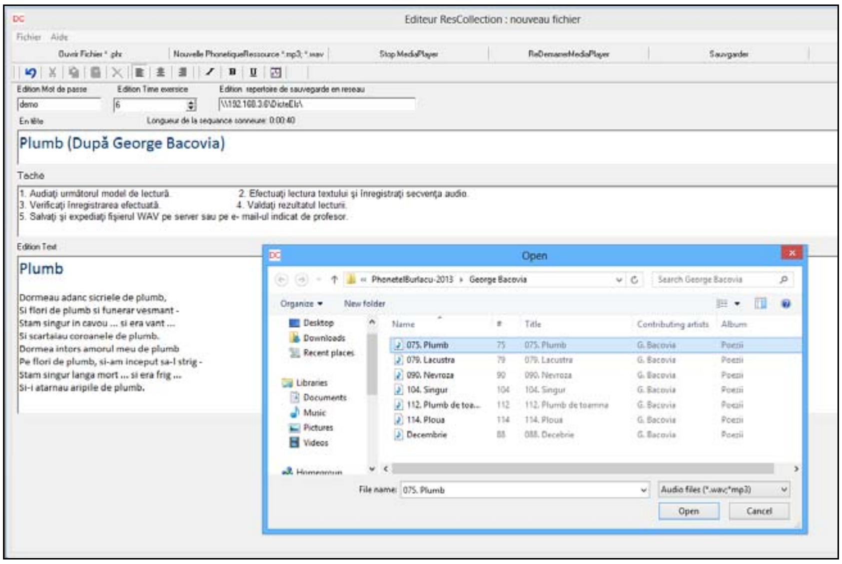

Figure 2. **The application interface "ResursCreator"**

3 Aria of transversal computer skills developed and formed through own designed educational software

In order to determine the degree of efficiency of given apps in the process of studying the integrated course of Romanian language and literature in the school, during the spring of academic years 2014-15 in theoretical lyceum "Petre Ştefănucă" from Ialoveni (Republic of Moldova), was triggered a pedagogical experiment with implementation of ES developed for "Digital laboratory specialized to study Romanian language" ("DLSSRL"). At the stage of familiarizing teachers and students participated in the experiment with the educational software "DLSSRL" have been taken into account precious requirements and suggestions of teachers, who have worked with us in pedagogical collaboration, also have been included students' wishes.

Pedagogical experiment's (PE) scenario provided the evaluation in the classroom and, also after lessons activity, individual work of TCS of school population. Evaluations prescribed testing skills set from the start and its measurements continued in the following.

TCS developed and formed through own designed educational software has been targeted such abilities as:

- Navigating in proper way via resources of personal computer file system, considering the tree structure and location of the computer system documents and files in the given hierarchy.
- Sure handling results of navigation via file system resources, applying its in order to execute the assignments set by teaching approach.
- Right working with connected to the personal computer devices, such as keyboard, headphones, speakers, microphone.
- Running audio sequence issued through interactive-multimedia robot of educational applications "DictEl" and / or "RecitalMaster".
- Management of audio sequence launched and translated through the interactive-multimedia robot of educational applications "DictEl" and / or "RecitalMaster".
- Hearing and editing of own recently performed audio sequences and issued by interactive multimedia robot of educational applications "DictEl" and / or "RecitalMaster".
- Hearing audio sequence (reproduced through the interactive-multimedia robot of educational applications "DictEl" and / or "RecitalMaster") and reproduce it by registering from keyboard unit in a textual sequence.
- Developing and training a suitable typing that consists in the correct spelling from keyboard unit, process of text's writing being optimized by proper placement of the fingers of both hands on the keyboard surface.
- Developing and training a suitable typing synchronized with the correct spelling from keyboard unit, process of text's writing using accordingly the Romanian language-specific diacritical marks.
- Developing and training a suitable typing, being implemented own virtual keyboard of our educational software and / or Touch Keyboard Built-in current version of Windows.
- Storing on local computer, local server and / or remote server own records of dictation (type as: dictation of words // selective dictation; auto dictation; commented dictation; instructive dictation; control dictation; preventive dictation, etc.) made under the running an audio file delivered via interactive-multimedia robot of educational application "DictEl".
- Recording into audio file format a literary text exposed orally, in accordance with the reproduced model of expressive reading by the multimedia robot of educational software "RecitalMaster".
- Verification of own records maintained in a sound file format a literary text exposed orally, in accordance with the reproduced model of expressive reading by the integrated multimedia robot of educational application "RecitalMaster".

— Saving on local computer, local server and / or remote server own records in an audio file format a literary text exposed orally, according to the model emitted through the agency of expressive reading by the multimedia robot of educational software "RecitalMaster".

It is noteworthy that in the during of PE computer, with other components and implemented peripheral devices, have not been included in order to substitute teacher and his role in the didactic process. Embedding of digital systems in the daily school's study of integrated course of the Romanian language and literature have formed a harmonious creative tools called upon to promote, improve, refine, fertilizing, varying, to complement traditional forms of teaching-learning-assessment through the educational applications components of interactive-multimedia complex "DLSSRL". Within PE teacher's role is authorized person to exercise the position of instructor / ICT trainer guiding the student activity.

All learning student's actions is based on active-participatory methods and techniques, group interactive and constructivist. Therefore entering the game following elements of learning: (1.) guided discovery mediated by the interactive-multimedia ES; (2.) collaborative learning, sometimes versus competition, finally expressed as: (a.) positive interdependence; (b.) promoting learning through direct interaction; (c.) personal responsibility of the student, manifested predominantly during the interaction with applications of educational kit "DLSSRL"; (3.) the interpersonal communication skills (also in the small groups), especially certified in the activity of recording dialog sequences of epic literary texts, dramatic, lyrical in working with the app "Recital Master"; (4.) activity monitoring of information processing in group (group processing), valid also for ES "RecitalMaster".

4 Conclusions

Comparing the initial and final competences of the school population in during of studying integrated course of the Romanian language and literature we have noted a visible increase in the quality of TCS.

Obtained success could be registered not only as model of ES elaborated based on *the pedagogical-technological format of modern ES development* [Burlacu Natalia, 2014; Burlacu and Balmuş, 2014], but also as an effective method of language training for representatives of gymnasium and / or lyceum levels, both applicable in an auditorium contact of learner-professor partially, or fully, or at the distance learning and self-regulated learning mode.

From technological point of view applications of ES complex "DLSSRL" are completely customizable and can be perfectly adjusted in cases to study others modern languages.

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Designing an End User Auto-Adaptive Interface for Inventory Software Application

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Abstract

In the field of logistics inventory there are a variety of training end users of software applications. An application must be simple enough to be used by a handler, but also refined operating to provide solutions to extract specific data or to define new operations without changing the application structure. There is no longer sufficient organization object-customer interface, as changes and the structure of the queries. Between end-user interface and the database client interface appears another level specialized in adaptation of the two interfaces. The paper aims to highlight this level and the changes imposed to other levels.

Keywords: graphics user interface, design application

1 Introduction

A software application can manage the logistics inventory for one or more deposits, real or virtual, the latter being used to replace some of the criteria were not added.

The first users of an application for logistics inventory are those working in the warehouses. Also, the software can be used on the supplier and even customers. Level of training of those that operate with the software, and can be very different. For example manipulators of the deposit will be limited to current operations reception (inputs) / transfer or delivery (outputs). The items once received, will be found in the application by unique codes taken by scanners. If the goods/items which are to enter into warehouse have not barcodes, they are generated by the application at the entrance of in the warehouse. However, there are operations that must be performed editing on new items / goods.

A warehouse operations can be done in real time, for example a document accompanying the goods may be developed by application and application software from the receiver / customer can notify him about loading the goods. Receipt of goods can be achieved without passing them through stock (cross docking operation), these being prepared for delivery directly.

A new equipment can be placed either by warehouseman on the note entry reception accompanying the goods at reception or by the customer by placing an order to deposit. The information flow for a typical inventory management application is shown in figure 1.

2 Analysis of end user interface

Sometimes the user perform simple operations, routinely and there are times when an item search process becomes more complex.

An ergonomic interface must provide:

- a maximum of information in terms of a number as small as possible for controls simultaneously displayed on the screen;
- a number, as small as possible from windows, to be completed in order to perform an operation;
- the possibility of using selections and for this are used catalogs of products. Applications can build dynamic selection lists with key/value already introduced so that the user adds a new key/value only if it is not in the list.

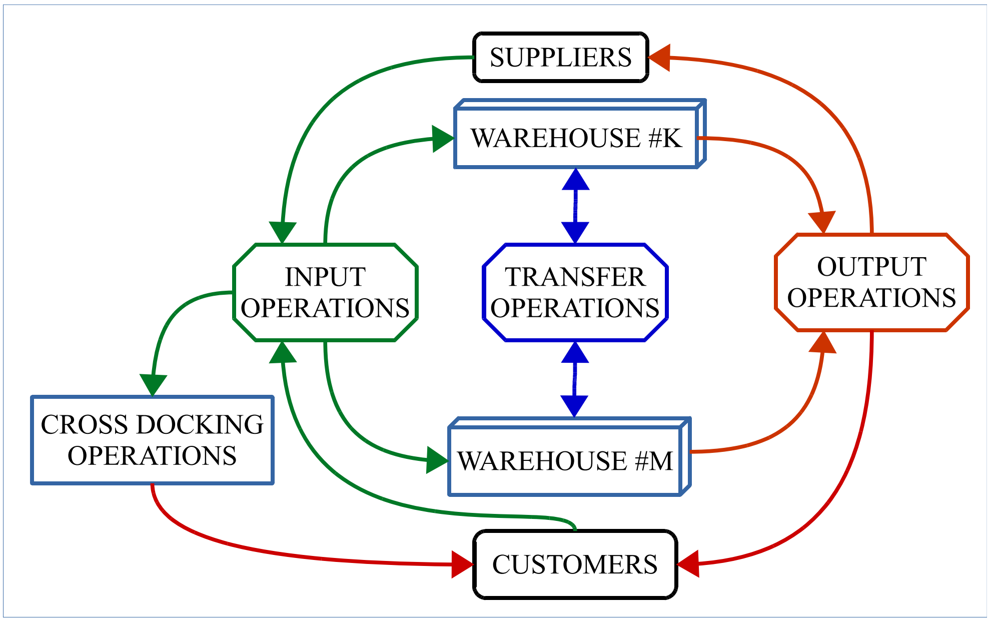

Figure 1. **The Structure for Typical Inventory Management System**

Main categories of operators/users are shown in figure 2.

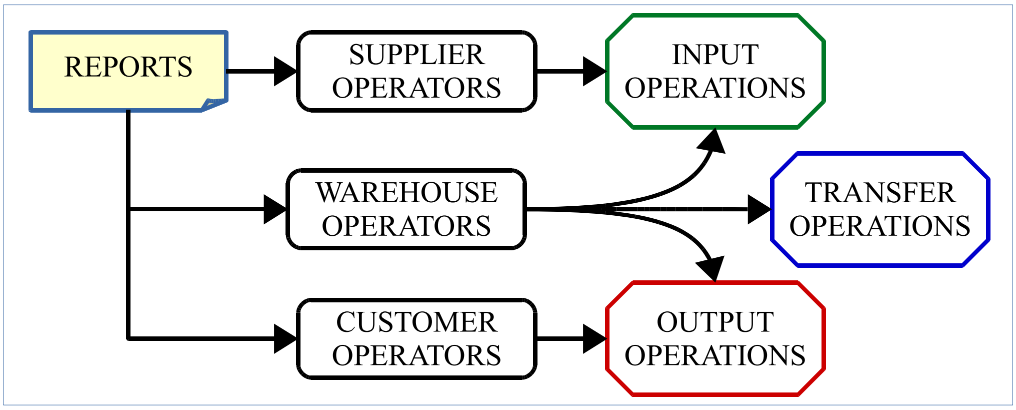

Figure 2. **General Informational Flow with Operators**

Any write operation performed by the user can be the source of errors.

3 Extended Interface Module

Construction reports are dynamic, so reports provided by the server to be obtained through a configuration performed by the users immediately prior to launching the query, or can be predefined the user choosing a particular type of report.

To enable the operation of the application software is required to process a minimal amount of information (basic information) in order to establish the following selection criteria to be in the moment editing tasks execution. The extended interface module (EIM) is shown in Figure 3.

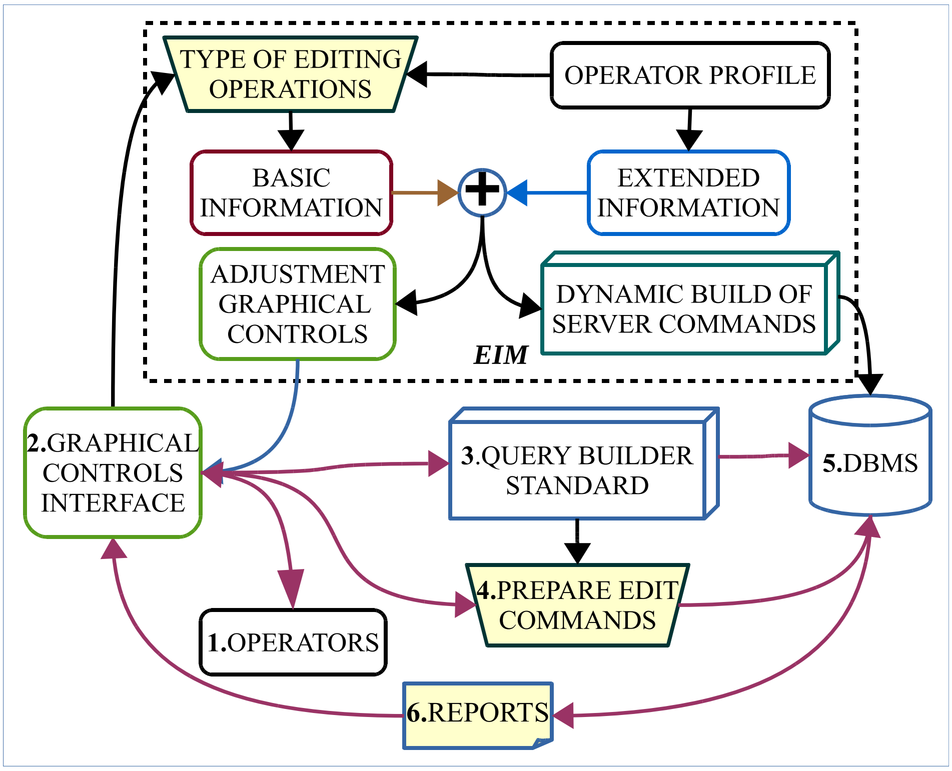

Figure 3. **Extended Interface Module Flow**

User access rights will affect the possibilities of configuration; given by *OPERATOR / USER PROFILE*. Depending on the type of editing operations are established minimum requirements regarding data flow (*BASIC INFORMATION*).

Editing operations often involve selections and operations; for example the selection of items in stock which will be delivered. The user, according to his profile associated rights has the possibility customize *reports selection* for editing. It also has the opportunity to search for specific items by criteria that are not accessible to other users.

Data Base Management System (*DBMS*) server receives a query command which will include supplementary information, information that no longer allow editing flow due to differences in data structure. Because of this, it is necessary to extract basic information from this result and setting editing commands only based on them (*PREPARE EDIT COMMANDS*). Selections for editing will be done using a graphical user interface (*GUI*) with data enlarged but will not be used than the basic.

4 Case Study

In order to example, I present a particular situation within a logistics software inventory, which I realized it some time ago, the software manages warehouses containing telecommunication equipment.

In order to the establishment of a "bordereau preparation" (the box is transformed into "delivery bordereau") is required the selection items in stock. This selection occurs only on deposits for which the user has access, in addition, it can use a standard query panel (Figure 4) or use a panel in which they can build their own queries (Figure 7).

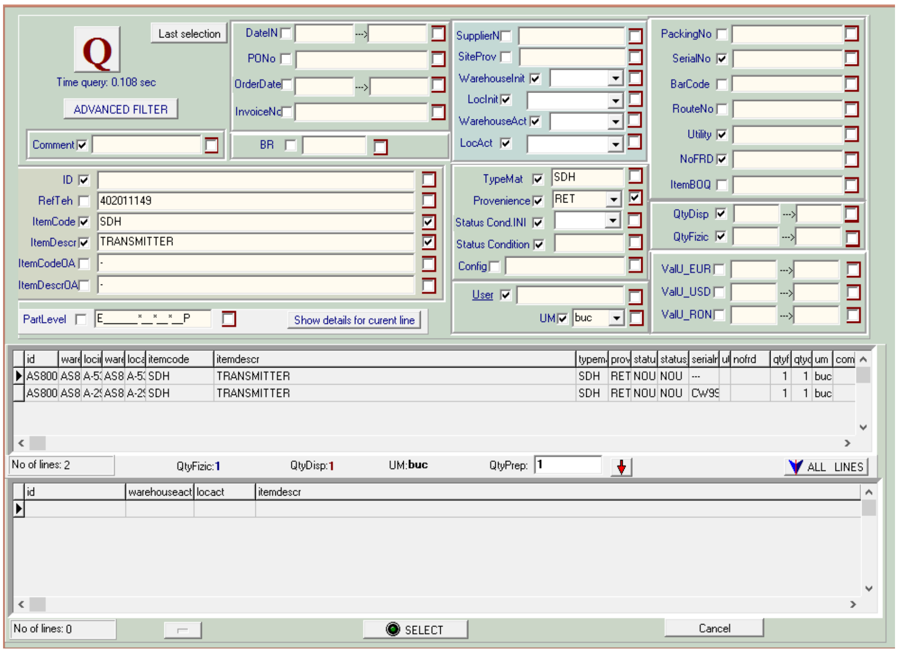

Figure 4. **Standard user interface example**

The controls type checkbox to the left of the edit boxes are used for selection, the criteria will appear as columns in the result table. The controls checkbox on the right side of the edit boxes are used to filter results. The query is performed by pressing the button ***Q***. The table columns are displayed as display controls are selected (checkboxes to the left of the edit box), and absence any selection will display only the total amount of stock regardless of type.

In this interface combo box lists some of the controls are set dynamically depending on available data. The user can add what is not in the list, but these reduce access speed, when opening the window due to access DBMS's.

Based on these selections is built the SQL command string that is passed to the server. Before transmission will automatically check some conditions for setting minimum data selection, data such as location, unique item identifier and so on. This SQL command, consists of a function call plpgSQL (figure 5 and figure 6). that has the form:

***CREATE OR REPLACE FUNCTION* cso.q_st**(_nr_ **integer**, _tip_ **character[],** _a_ **boolean[]**, _s_ **boolean[]**, _vala_ **text[]**, _valc_ **text[]**, _vald_ **text[]**, _valn_ **numeric[]**, _valb_ **boolean[]**, _vall_ **loc00[]**, _nume_ **text[]**, _ord_ **text**, _tabel_ **text[]**)
***RETURNS* text *AS* ...**

Figure 5. **The parameters of plpgSQL function**

where the function arguments are input parameters and their meaning:

- ***_nr_*** - number of criteria;
- ***_tip_*** - criterion type (alphanumeric exact matching, approximate matching alphanumeric, numeric, boolean, user defined data types and so on;
- ***_a_*** - vector that contains check for criteria which are displayed (columns);

- ***_s_*** - vector that contains check for criteria which constitute filter query;
- ***_vala_*** - vector with alphanumeric values of edit boxes - approximate search;
- ***_valc_*** - vector with alphanumeric values of edit boxes - exact search;
- ***_vald_*** - vector with the second value for the type of calendar date (first will be stored in _valc_ or _vala_);
- ***_valn_*** - vector with numeric values of edit boxes;
- ***_valb_***- vector with values of boolean type;
- ***_vall_***- vector with values of user type loc00, where loc00 is SQL data type defined by the user, containing a hierarchical structure of locations;
- ***_nume_*** - vector containing the the corresponding field names criteria;
- ***_ord_***- criteria that will be the key result sorting table;
- ***_tabel_***- vector containing the the name of the DBMS tables corresponding to each criterion.

The function returns a ***text*** value if the procedure is executed completely, it returns ***OK***, otherwise return a message. In the function are tested various restrictions, for example, existing test text in the edit control if attached filtration control is unchecked.

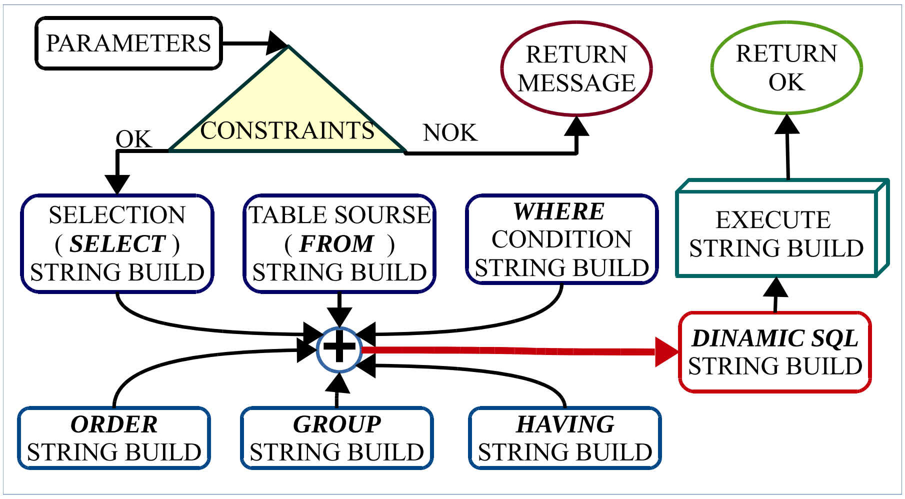

Figure 6. **Structure of the function**

The result of the function execution will be stored in a temporary table provides the basis for control of grid type, of graphical interface. Temporary tables may be used only with persistent connections; and in case of failure of the connection with the DBMS can lead to temporary shutdowns for the application. It can abandon the temporary tables, but increases the difficulty of a graphical user interface and constraints must be tested by another function.

In order to customized interface, the filter can be provided through the use of complex nested expressions of type ***AND / OR*** (figure 7).

Conclusion

The method of separating data from extensive database allows expanding the selection options of GUI data without changing the application structure. Development options for the data selection is limited possibilities of GUI controls. There are becoming more frequently used nested grids, but increases the complexity of the relationship with data from DBMS tables. Interface of the case study was done in C ++ Builder with the DBMS PostgreSQL.

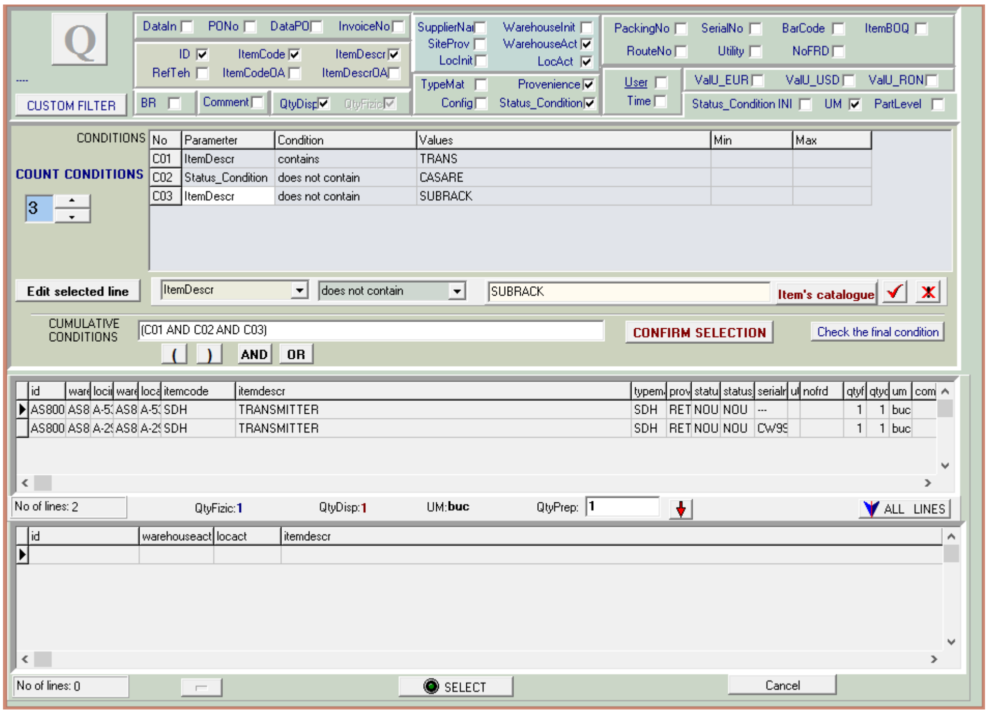

Figure 7. **Custom user interface example**

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Recursive Techniques in Designing Software Applications to Assist the Quality Management

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Abstract

The dynamics of economic industrial processes requires a continuous updating of quality handbook. An application that supervises the activities of an entity economic industrial will have to be adapted; to implement a self-learning mechanism. The present paper aims to outline an architecture for a software application that could meet the demands resulting from the modification of the structure of industrial and economic processes. An application software that assists in the quality management be constituted and a self-learning application for the user, because emphasizing the issues that could not be identified when developing software. The question of taking over these issues in the software application, which initially did not take account by them; without structural change application.

Keywords: quality management, software design, layer

1 Introduction

Quality Handbook contains a detailed description of all activities in an entity. The activity is decomposed into processes and embedded subprocess, and quantified over time. They also detailed the resources allocated to each process or subprocess on. This allocation of resources and processes, is followed by setting the synchronization of their over time.

Any process can be conditioned by a certain stage of execution of another process, each step can be represented by one or more sub-processes. Quality Handbook covers and response to external events that are not related to a normal course of activities. Because of this quality handbook is in continuous improvement through revisions that are made on it. Quality Handbook underlying quality management, and help design software applications for management activities.

2 Overview About the Design of the Software Quality Management

To be implemented in quality handbook, resources and activities, corresponding to an entity are quantified. This quantification of the activities underlies constitution of knowledge database for an expert system.

Data from the scheduler activities are taken over by the allocation of resources – Resource Allocation Control in Time (***RACT***). It launches processes based on available resources so that their execution is optimal. Existing resources, including materials may have some dynamics in time. For each activity there is a detailed timeline progress of all processes with the given resources (figure 1). This allows synchronization of the activities and optimal use of resources involved.

Assessing the response given by the execution of each process / subprocess is required in the dynamic reallocation of existing resources. For example, a subprocess can blocking, in which case will be initiated another equivalent subprocess, with the possibility of full or partial use of other resources.

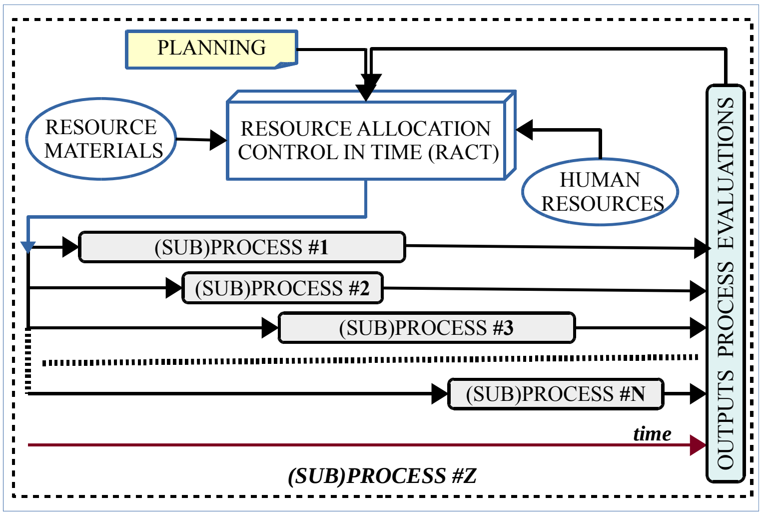

Figure 1. **Decomposition Activity in Embedded Concurrent Subprocess**

3 Decomposition in Layers of the System

The execution of a process can be divided into several layers (Figure 2).

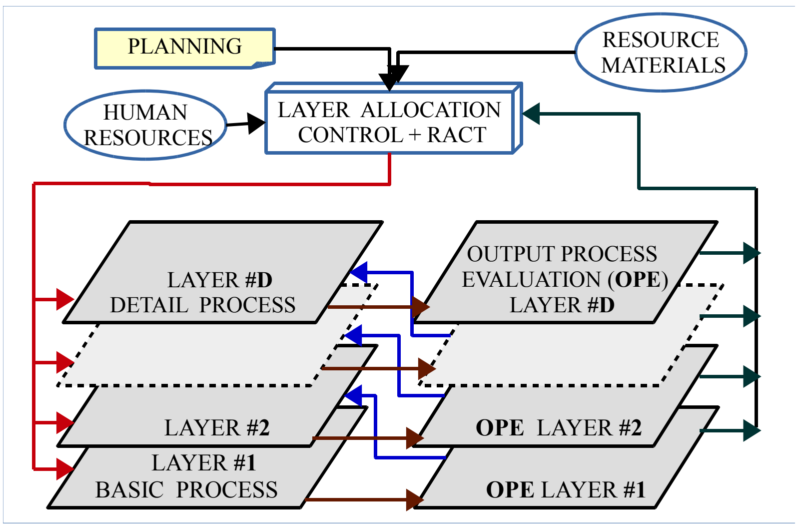

Figure 2. **Communication Between Layers**

On the the base layer will be based processes that provide general execution, such as electric power, transport between jobsites and so on. On the last layer will be short processes, ultraspecialized such as interpretation of results (figure 3).

When there is a new process that materialized on the ***W*** layer (eg by providing information) it can extend to the base layer with ***K*** levels. It is possible that the link to the layer ***W-K*** is not direct, however, there can have processes that influences all layers up to layer ***W-K***. (ie that process may require the existence of another process that has links to ***W-K***). Adding new process involves rebuilding all links starting with ***W-K*** layer to layer ***W***. The allocation of resources for a new process is shown in figure 4.

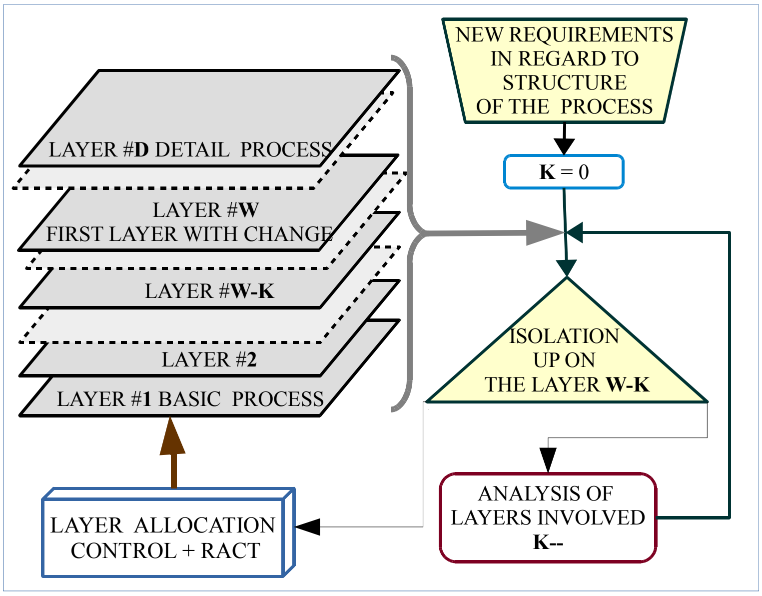

Figure 3. **The Allocation Process Across Layers**

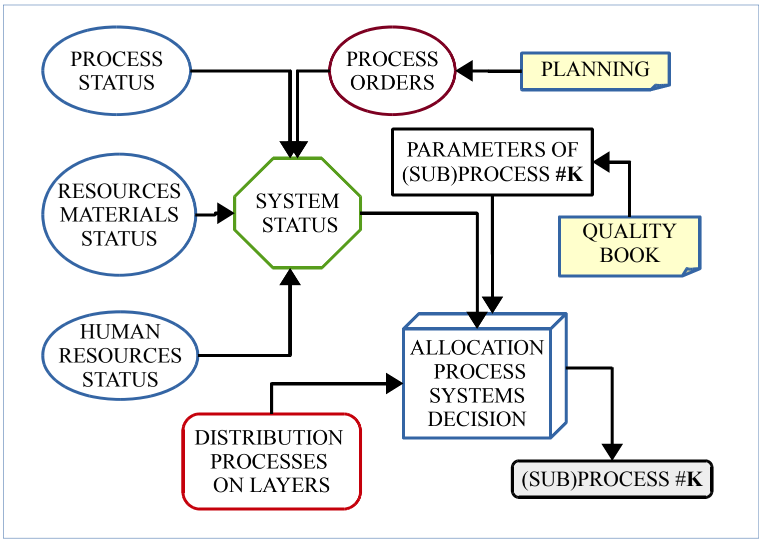

Figure 4. **Resource Allocation**

Search for all links from one layer to another can be achieved by a call of a recursive search functions, in which case the search direction is passed as arguments to this function.

The decomposition of processes will lead to a hierarchical tree structure, with the root on the the base layer; and on the the upper layers leaf nodes.

4 Case Study

For example I chose the activity in a laboratory analyzes and tests. In an accredited laboratory whole activity is done according to quality handbook “(Guslicov, 2009)”. The flow of resources is detailed in figure 5.

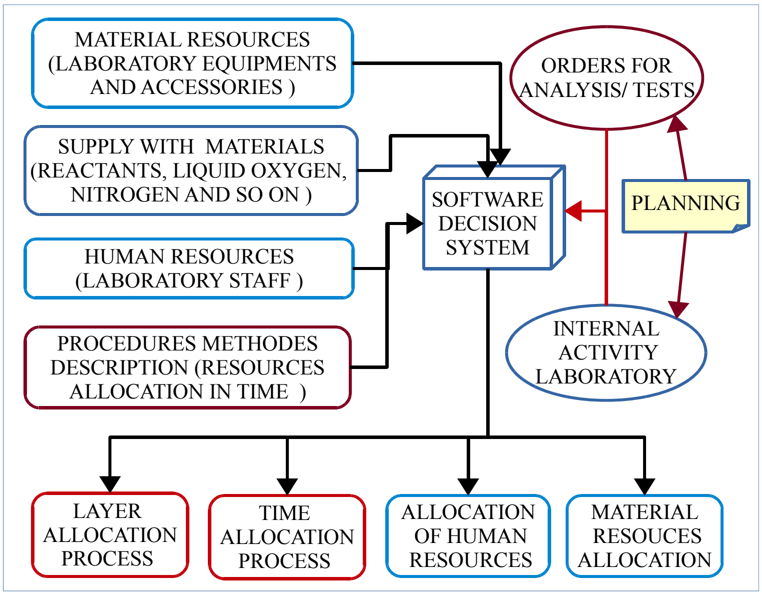

Figure 5. **Resources Flow in a Laboratory**

Suppose that the initial laboratory is equipped with a diode array spectrophotometers and then is replaced with UV/Vis Spectrophotometer. These spectrophotometers represents material resources whose change induces a change of other resources both material and human resources.

However there are layers that are not affected by this changesuch as structure analyzes performed (this layer is lower than that which is spectrophotometer - under ***W-K***). and results interpretation; layer that is above the layer ***W*** (figure 6).

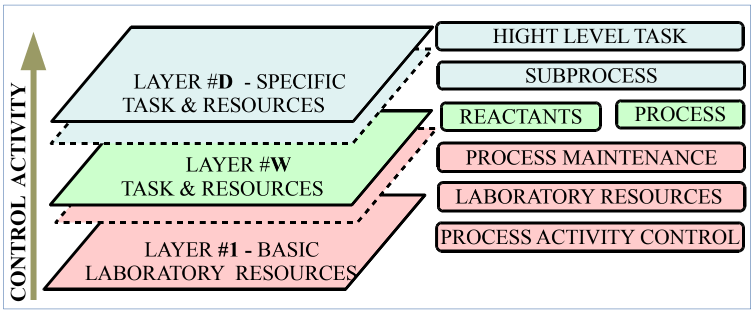

Figure 6. **Across Layers Decomposition Processes in the Laboratory**

In order to implement the software, it impose a distributed resource control. In this regard, if a design of object, are defined classes such as (figure 7):

- ***ResourceControl*** - DBMS software interfaces that contains resources available, and those allocated;
- ***TinerControl*** (resource time is treated separately) - only deals with synchronization of processes / sub receives signals from objects of type Process on commencement, interruption or completion;
- ***ResourceTimeAllocation*** - distributes human and material resources to each process;

- ***LayerControl*** - allows for the resources and processes across the layer; dealing with processes and resources distribution layers;
- ***Process*** - a process controls; from his appearance to completion, completion of the process is reflected in a new resource - can be just the information.

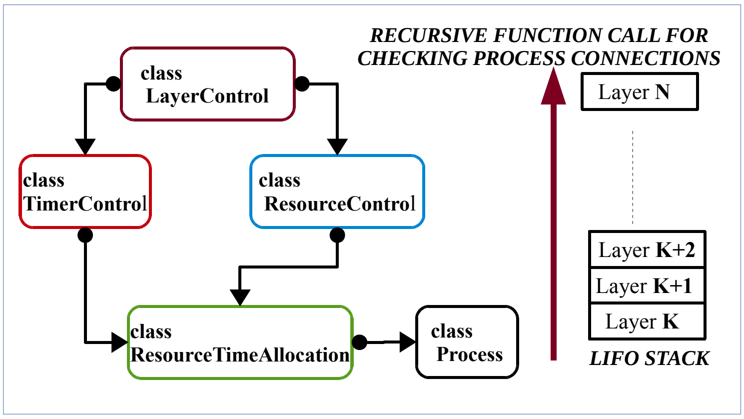

Figure 7. **Checking the Connection Process**

Conclusion

Distribution in layers, limits the effort reconfiguration of software for quality management. The upper layers correspond to final results, where the top layer of a laboratory of analyzes is the interpretation of results of the analysis, the layer immediately below the test results. Basic layer corresponds to the power supply and the flow of basic materials.

Basically the structure of these processes can be simulated by reverse trees, tree roots are on the base layer and the leaves of trees are on the upper layers. For this reason, the simplest way to search and to restructure trees is that the use of recursive functions; they received as argunent the new search directions. All tree nodes will be on layers. Each node of the tree in relation to adjacent nodes will be on the other layer.

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S e c t i o n

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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**

Running OER MOOC Electrical Engineering and Technology Courses by Using Moodle Platform

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Abstract

The article describes the educational and research project at the "Gh. Asachi" Technical University of Iași in the fields of e-Learning and Blended Learning. In these projects, epedagogy of using ITC learning environments was used. Elearning Moodle Platform of "Gh. Asachi" Technical University of Iași uses a virtual learning environment for training and learning process improvement dedicated to engineering students. The article presents some methodological elements that contributed to the success of the Project. Several web courses, based on Blended Learning methodology are highlighted. This paper presents elearning instruction materials for engineering undergraduates developed on the Virtual Learning Environment http://moodle.ee.tuiasi.ro/. Processes of: design, development and implementation of interactive educational modules are presented, for the topic of electrical engineering and technology.

Keywords: Engineering Education, Blended Learning, Open Educational Resources, Virtual Learning Environments, e-Pedagogy, Moodle

1 Introduction

Teaching Engineering as one of the components in the foundation technological program has been a challenging task to electrical engineering lecturers. A course webpage was constructed with the Moodle software system that utilizes various applications such as forum discussions, on-line assessments, accessing course information and learning resources including videos and useful links. The web application is not a duplicate of classroom content but serves as a complementary to further provide guidance and assistance to students' learning outside the classroom. Therefore, the research will investigates students' perception on the usefulness of the course webpage in terms of content, accessibility, satisfaction and whether the experience stimulated their interest towards learning Engineering. The hybrid approaches offer flexibility and provide adequate support to students in learning EET.

The principles of ICT integration in engineering education are expressed as seven specific learning objectives for Teaching Engineering by using Blended Learning:

1. Critically apply the pedagogical principles of ICT integration in education.
2. Develop and facilitate ICT-based learning activities in the context of teaching EET.
3. Analyse and evaluate appropriate content and context for the use of ICT in EET teaching.
4. Use appropriate and varied communication and multimedia tools (emails, websites etc) in teaching and learning EET.
5. Use ICT efficiently in research, problem solving and project-based learning in EET.
6. Use ICT efficiently for professional development in the context of teaching and learning EET.
7. Integrate ICT appropriately into EET curriculum activities that will foster students ownership of their ICT-rich learning environment.

Methodology. Electrical Technology courses in higher education have traditionally been composed of lectures, problem-solving sessions, and laboratories. This study was aimed at developing a freshmen Web-based EET course and investigating the performance of the students who use it. The course Web site included the following elements:

- Weekly problem sets, for which solutions were provided a week later
- Hyperlinks to Web sites that provide information about topics in EET that are relevant to the course, including historical and philosophical background
- Hyperlinks to sites that provide access to free computerized electrical circuits and drives modelling software
- An electronic forum that enables students to pose questions and instructors to answer them
- An optional, individual CMM project. The Capability Maturity Model project was originally developed as a tool for objectively assessing the ability of government contractors' *processes* to implement a contracted software project.

2 Using the Moodle Platform in Class

Moodle is a tool which enables teachers to create a website environment for your class with online activities such as forums and quizzes.

“Moodle is a Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It is a free web application that educators can use to create effective online learning sites.” (http://moodle.org/)

Course Webpage Design and Description by using Moodle platform (VLE, Virtual Learning Environment)

The blended learning environment was designed for a course entitled “Electrical Engineering and Technology, EET”, which was a core module offered to engineering students. The front webpage provides the overall course content of the EET module with the names of the chapters, followed by the activities in a drop-down list for each chapter. The activities involved in each chapter include: course materials, additional materials, quizzes, open forum/chat and latest news message/calendar.

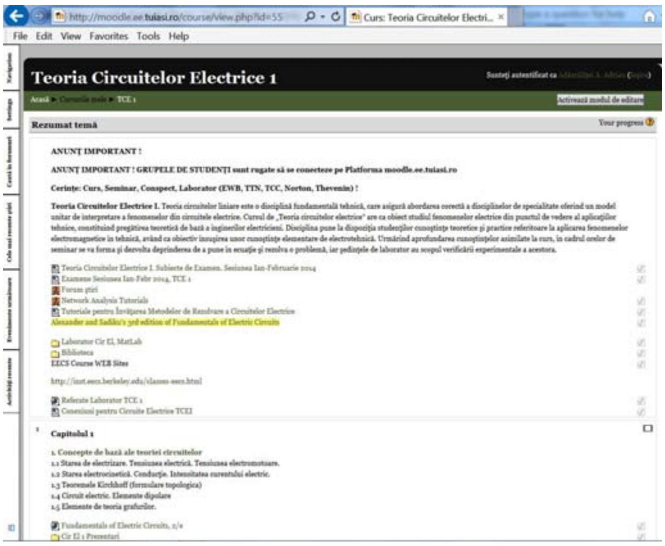
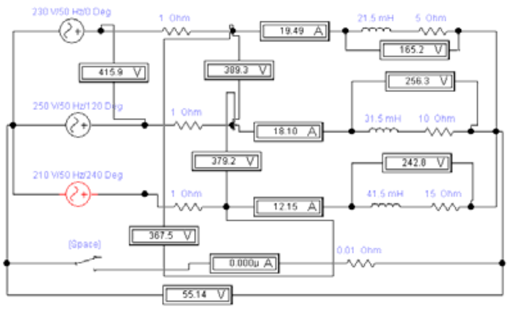
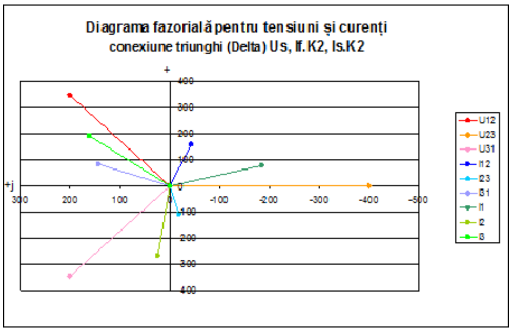


Fig. 1. **Blended Learning course developed at the Technical University, Iași, România**

Course materials. There are a total of … chapters in EET with topics of namely, … Each of these chapters has plenty of information and activities related to the topic. This includes the course materials in the form of PowerPoint slides and Acrobat PDF documents, which are the duplicates of hand-outs that the students received in class. It is important to provide a softcopy to the students, as it is coloured compared to their hardcopy and helps better in comprehending complex diagrams or figures.



Unbalanced three-phase circuit Laboratory experiment.



Symmetrical Components Calculator

Fig. 2. **The Content Presentation of Computer Simulation for "Electric Circuits"**

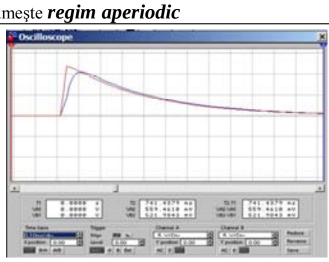
Nowadays students are very much visual learners. The majority of the students expressed the strongest preference to visual learning style compared to other learning style dimensions. This implies that engineering students are strongly depending on visual learning environment. Video is clearly a valuable additional learning activity that provides a sensory experience that allows concepts and ideas to actually become alive and connected. It has the option to rewind and review a particular section of the video to ensure students understand the key concept. Thus, free educational video sharing websites that explained the EET theories were uploaded in the webpage. In addition to this were video links from You Tube. Apart from this, problems and solutions as well as simplified diagrams explaining complex concepts, taken from textbooks or take-home questions which were not discussed in class, were made available online for students. In each of these adapted materials, references were stated clearly in order to allow students to seek the original sources if the need arises, apart from avoiding copyright infringement.

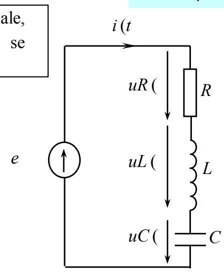
$$\alpha = \frac{1}{2}\frac{R}{L} \qquad \omega_r = \frac{1}{\sqrt{LC}} \qquad LC \cdot \frac{d^2 u_C}{dt^2} + RC \cdot \frac{du_C}{dt} + u_C = 0$$

R (ohm)	L (H)	C (F)	alfa= constanta atenuare	omega rezonanta	beta	R critic
400	0,01	0,000001	20000	10000	17320,51	200

$$R_c = 2\sqrt{\frac{L}{C}}$$

$\alpha > \omega_r$, adică $R > R_c$. În acest caz rădăcinile sunt reale, negative şi distincte, iar regimul liber al circuitului se numeşte ***regim aperiodic***





$$\beta = \sqrt{\alpha^2 - \omega_r^2}$$

Fig. 3. **The Content Presentation in "Transient Regime in RLC series circuits“ (Open Office Calc spreadsheet, analogous to Microsoft Excel).**

Quizzes. Quizzes were incorporated in each chapter for students who were keen to self-test their knowledge and learning after the revision of a chapter. Short quizzes in the form of true/false, multiple choice, short answers or numerical questions were assigned, depending on the chapter content. The majority of the questions were of problem solving type that involved calculation with pre-determined specific units and significant figures of the numerical answers. Two attempts were allowed for each question and the students received immediate feedback if they failed in their first attempt. Positive responses were provided if the students were successful in answering the questions. However, there was no time limit to answer each question as the students were given sufficient time to read and understand the questions, and to answer calmly at their own pace.

Since the quizzes were not part of the students' assessment, it was considered as an independent study at the students' own will. Hence, the quizzes were designed with a due date of two weeks, in order to encourage the students to have a constant revision and to avoid last-minute cramming before examination.

Open Forum. Open forum serves the purpose of allowing a student to post his/her questions or doubts and can be viewed by their fellow peers. This allows the lecturer to disseminate the answered questions to the whole class without repeating in the classroom. Hence, each of the chapters was constructed with their very own Open Forum. Students were also encouraged to use the chat function that facilitated live discussion and interaction with their instructors and peers.

Latest news Message/Calendar. Another interesting feature of Moodle is the function on the right of the webpage which allows the lecturers to post any new messages. It also comes with the list of recent activities so that students can keep-track with any updates. General announcements such as due date of assignments, examination dates and venues, replacement classes etc. were posted at this section and these were linked to the students' email accounts, so that they were notified of every update.

3 General Presentation ff Open Educational Resources and MOOCs

Open Educational Resources (OER) have the potential to broaden access to education and to improve the quality and cost-effectiveness of teaching and learning in Europe. The best way to put OERs into practice is through Massive Open Online Courses (MOOCs). MOOCs are large-scale courses that represent one of the latest developments in open education, an initiative that is always trying to improve quality, access and equality in education and training.

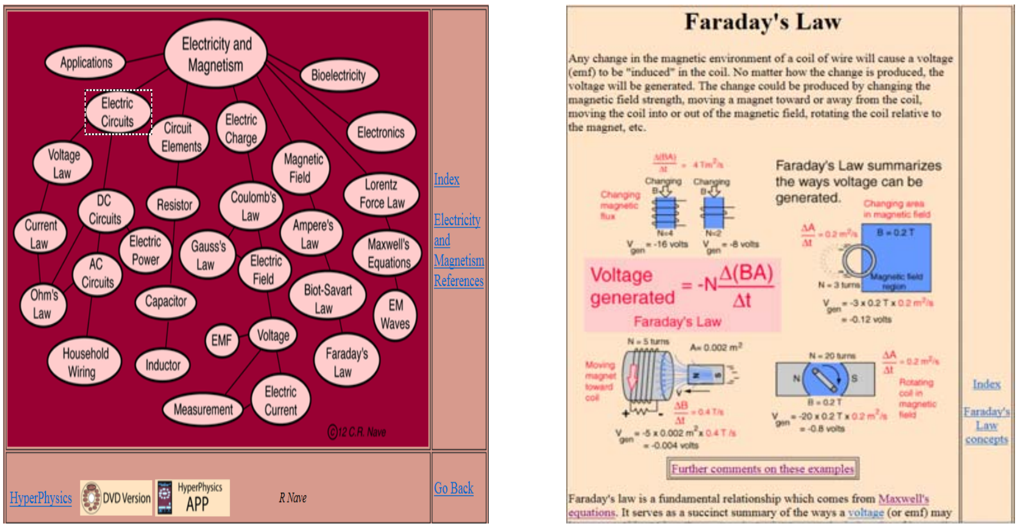


Fig. 4. **Hyperphysics, Electricity and Magnetism, http://hyperphysics.phy-astr.gsu.edu/hbase/emcon.html#emcon**

MOOCs can be implemented in formal, informal and non-formal learning, and make learning ubiquitous.

Project will use leading-edge technology to create a combined Moodle MOOC platform– based on individual platforms and resources provided by project partners – making it possible to combine and transfer pilot activities in all the hubs involved.

Project will contribute to increasing awareness of the advantages of open education in Europe. The project will prove the potential of MOOCs (courses and communities) for breaking down technological barriers in learning across people with special needs or at risk of exclusion.

MOOCs adopted definition: MOOC is an online course designed for large number of participants that can be accessed by almost anyone anywhere as long as they have an internet connection, is open to everyone without entry qualifications and offers a full/complete course experience online for free.

A MOOC includes educational content, facilitation interaction among peers (including some but limited interaction with academic staff), activities/tests, including feedback, some kind of (nonformal) recognition options and a study guide / syllabus.

Utilising the Virtual Lessons and Laboratory Resources for Electrical Engineering

Teaching electrical engineering laboratory procedures by means of a virtual laboratory on a personal computer will be much welcome by educational institutions for whom maintaining a hands-on electric engineering lab is not viable due to various reasons. Instructional laboratory simulations can be incorporated in the virtual laboratory resources where students are free to make the decisions they would confront in an actual laboratory setting.

4 Electrical Engineering and Technology eLearning Resources

Real-life situations and problems are faced by them, where they have to make/take decisions and face the consequences thereof.

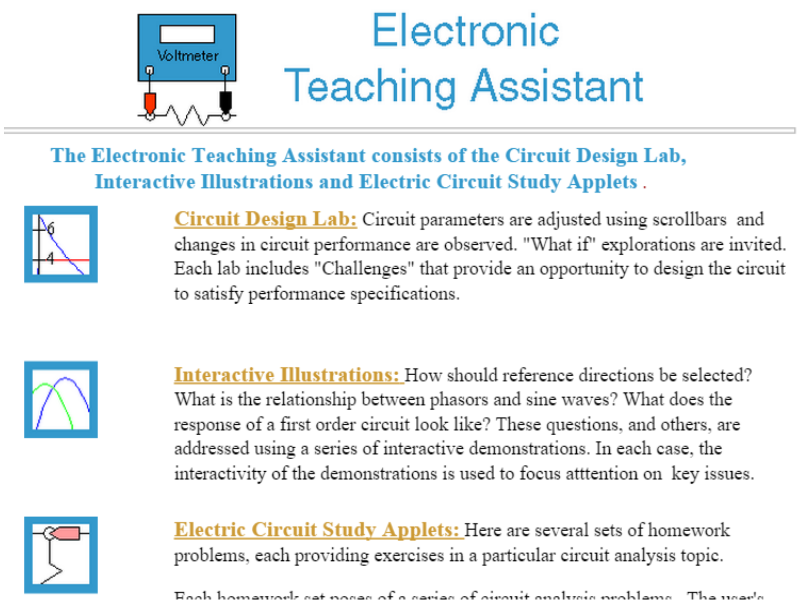


Fig. 5. **The Electronic Teaching Assistant: the Circuit Design Lab, Interactive Illustrations and Electric Circuit Study Applets**

The available links to following websites are given below as examples for the teachers to have an idea of such virtual laboratories (see Fig4. and Fig. 5.).

Conclusions

This paper presents elearning instruction materials for engineering undergraduates developed on the Virtual Learning Environment http://moodle.ee.tuiasi.ro/. Processes of: design, development and implementation of interactive educational modules are presented, for the topic of electrical engineering and technology. Elearning modules provide student with information examples containing rich multimedia elements: text, glossary, webography, bibliography, and knowledge and skills assimilation assessment. The modules are divided into a number of teaching and learning units which can be studied autonomously (or independent). Electrical Engineering and Technology (EET) Discipline model is a new approach to learning electrical technology-one that presents concepts in the customary logically developed order but illustrates them with exemplars that reflect the applications students are interested in. Electrical Engineering Discipline resources are especially for secondary school teachers and students, with topics ranging from introductory to advanced Electrical Engineering and Technology. Teachers will find reliable and quality resources including videos, articles, demonstrations, worksheets, assessments and activities all in one location. Resources are searchable by topic and standards. eLearning Modules are using visualization of electrical engineering concepts. These principles focus on a few specific pedagogical pointers: 1. providing multiple representations and descriptions; 2. making linked referential connections visible; 3. presenting the dynamic and interactive nature of electrical engineering; 4. promoting the transformation between 2D and 3D; and 5. reducing cognitive load by making information explicit and integrating information for students.

This paper is a synthesis that presents the conception of a project devoted to use moodle Virtual Learning Environment for the development of MOOC courses which mainly contains OER materials in order to educate the Engineering Students.

Engineering School teaching and students' learning are moving through transition processes that use education technology in support of academic work. There exists a greater acceptance of the online mode of instruction as an adjunct to learning. Nevertheless, the results of our work showed that most students preferred a moderate use of e-learning in their courses. Their positive attitude was observed towards the model of blended learning approach, and Moodle platform did create a positive impact on students' learning experiences in terms of the accessibility of learning materials and the support of online assessment activities. Students reported that the most valuable benefits of using Moodle platform in learning EET were the convenience of accessing the course materials and completing the online assessment tasks. Overall, the majority of the students perceived the use of course website as an opportunity to enhance their academic experience.

Although the students agreed that the hybrid learning provided them with the needed assistance, one of the drawbacks observed was that this method of delivery was prone to become a one-way communication. Responses to this study showed that the number of the students' email correspondences to the lecturers were minimum. The students were expecting to be "spoon-fed" with information, announcements and notes. Thus, a more interactive learning is needed to promote a two-way communication. Communication tools such as forum discussion and online chat room have the features that create interaction with instructors and among the peers. However, as mentioned earlier in the study, most students are likely to participate in the learning practices only if the activities are considered as part of the evaluation of their academic performance. It is therefore necessary to assign grading procedure in e-learning activities to increase students' participation. With the improvements at these loose ends, Moodle application in Electrical Engineering will be an invaluable and imperative tool for the instructors as well as for the students.

Acknowledgement

We wish to address our thanks to all authors and institutions for the value of their ideas, concepts and information that we used in our project design. All sources are cited in the bibliography.

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[16]. Pearson Electronics Student Supplement Site! http://media.pearsoncmg.com/ph/chet/chet_electronics_student_1//
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Do you MOOC? An exploratory view for Romanian academic landscape

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Abstract

In the last years the European higher education is confronting with major challenges – the growth of education quality and correlation of teaching-learning process with ample needs of society and labor market; adaptation to globalization and a significant growth of students' number in HE institutions in the world, which affect the Europe position as world leader in education; enhancing and broadening the access at higher education through valorization of new technologies and pedagogies like OER (open education resources)/OEP (open education practices), MOOCs (massive open online courses) and flipped classrooms. At the moment, no Romanian university offers a MOOC course. Moreover, young people are not familiar with them; for instance, less than 1% of students at global level are from Romania. In this context, the authors explore the challenges MOOCs can offer for Romanian higher education institutions, to raise the access to education of thousands of students and to stimulate universities to adopt new teaching methods, more innovative and flexible.

Keywords: MOOC, open education, higher education

In the last years the European higher education is confronting with major challenges. In a series of documents about recent strategies [1] [2] [3], European Commission underlined these challenges – the growth of education quality and correlation of teaching-learning process with ample needs of society and labor market; adaptation to globalization and a significant growth of students' number in higher education institutions in the world, which affect the Europe position as world leader in education; enhancing and broadening the access at higher education through valorization of new technologies like MOOC (*Massive Open Online Courses*).

Although the MOOC movement became popular in USA and Canada (where also began in 2008), in Europe only in the last two years we're facing the "MOOC revolution" [4]. Thus in April 2013 was launched at paneuropean level the first initiative (OpenupEd) of this kind (http://www.openuped.eu/) with partners from 11 countries and run by the European Association of Distance Teaching Universities – EADTU [5]. On the other hand, the EU portal for quality OERs produced in the EU, indicates that in February 2015 there were over 1500 MOOCs[1], with a very strong interest in Spain, United Kingdom, France and Germany [6].

At the moment, no Romanian university offers a MOOC course. However, in Romania there are several ongoing MOOC initiatives [16]:

a) **Developing MOOCs**. Examples include:

- **UniCampus** (http://unicampus.ro): Started in April 2014 by University Politehnica Timisoara, Unicampus is a project supported by the Ministry of Education and developed by the Association of Technical Universities from Romania (http://rouni.ro) bringing together the country's main polytechnic institutes. The project will offer MOOCs on a version of Moodle platform based on cMOOCs methodology [11].

[1] See https://ec.europa.eu/epale/en/content/more-1500-courses-new-european-mooc-scoreboard

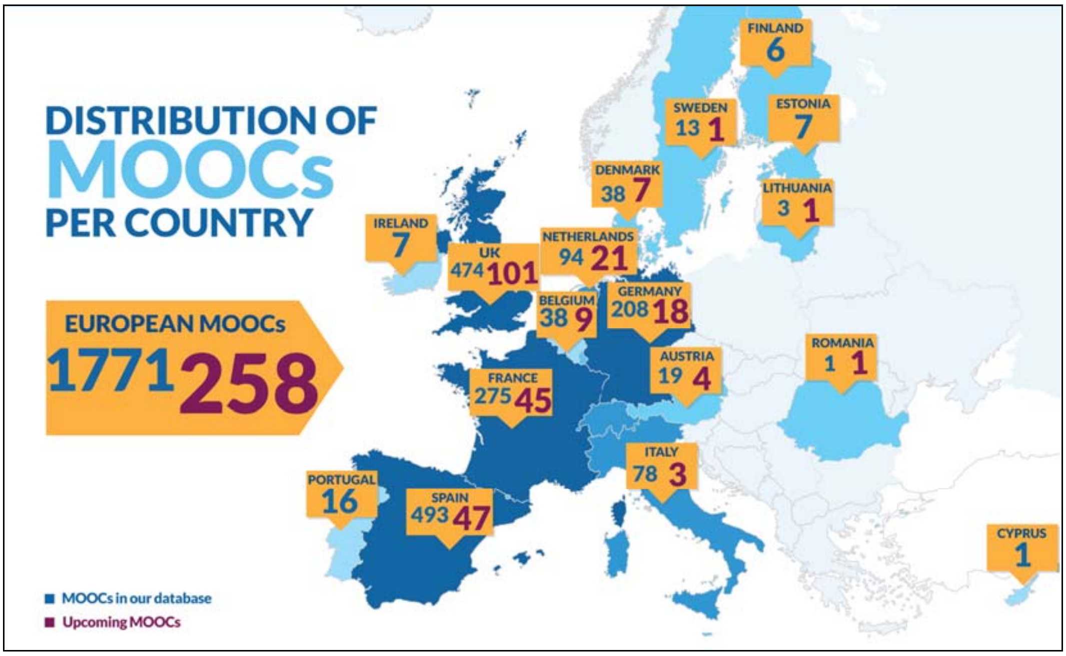

Figure 1. **European MOOCs Scoreboard (source [6], updated Sept. 2015)**

- **UniBuc Virtual** (http://www.unibuc-virtual.net): Credis, the Department of Distance Learning from Bucharest University, is developing three MOOCs for Teachers Training on a Google Apps-based platform.
- **„VasileGoldis" University from Arad** will offer MOOCs in partnership with Fédération Européenne des Écoles.
- **Critical Thinking MOOC** was developed and ran in 2014 by Maastricht School of Management Romania on Iversity (http://www.msmromania.org/content/msmro-produces-first-mooc-eastern-europe).

b) **Integrating MOOCs in blended academic courses**. Such projects can be found at University Politehnica Timisoara, for the Web Programming course and the Instructional Technologies course [12];

c) **Organizing scientific events** related to open education. For example, the Romanian Coalition for OER (http://acces-deschis.ro/ro/oer) organized two national conferences; University Politehnica Timisoara (http://elearning.upt.ro/workshop-opening-up-education/n-32-70-185/d) held workshops during the Open Education Week in March, 2014 and 2015; starting with 2014, the International Conference eLSE has a special section dedicated to OER and MOOCs, co-chaired by the first author (http://elseconference.eu);

d) **Publishing studies** assessing the degree to which students and teachers are familiar with MOOCs [11, 12, 16].

Moreover, young people are not familiar with MOOC courses; for instance, less than 1% of students at global level are from Romania. In this context, the proposed paper advocates in favor of a MOOC by a Romanian higher education institution. We consider the research enterprise of MOOCs as a central element of the strategy to raise the access to education of thousands of students and to stimulate schools and universities to adopt new teaching methods, more innovative and flexible.

On the other hand. according to 2014 Eurostat statistics, only 21,8% of the adult population has graduated a form of higher education, which places Romania at the bottom of the list [7]. A favorable reaction would be generating and implementing initiatives and actions which would result in access to and graduation of higher education for a larger segment of the population. With this goal in mind, our paper can be considered a good starting point, to anticipate the specific educational needs for a better response in preparing the labor force with low costs.

Due to the fact that MOOC courses are not entirely certified; having an overcrowded class; low rate of graduation; staying motivated; the absence of real human interaction; a fallible grading system etc. is possible that these type of courses to have a negative / opposite effect and to disrupt the academic life [8].

Despite all these limits MOOCs are heading to become a significant and possibly a standard element of credentialed University education, exploiting new pedagogical models, discovering revenue and lowering costs [9].

Developing and implementing in an innovative approach of a MOOC into the Romanian socio-cultural space is mainly based on the analysis of the training needs of educational actors. Thus, it is imperative to improve the training of teachers by carrying out a MOOC course which integrates open access educational resources (OERs). In order to achieve this one can take the following steps:

- Realization of a qualitative, prospective study regarding the development and implementation of MOOCs towards opening new research directions in the educational field.
- Implementation of a sociological quantitative research adapted to the particularities of the Romanian socio-cultural area.
- Elaboration of recommendations regarding educational policies of MOOCs implementation in the context of higher education institutions from Romania.
- Promoting examples of good practices and making pedagogical design recommendations in the valorization of MOOC resources offered within professional and continuous training.
- Creating an academic network between the Romanian universities, based on mutual knowledge of the realities and problems encountered in developing institutional and regional MOOCs.
- Publishing articles in specialized journals (BDI and/or ISI indexed) upon interpretation of research results.
- Developing teachers' new abilities and competencies (transversal skills) after participating in at least one MOOC; the course offers the opportunity to keep up with modern applications, technologies, and open educational resources.
- Facilitating access to continuous professional training by means of MOOC especially for socially and economically disadvantaged teachers.

The direction imposed by international researches is the customization of MOOCs to local contexts taking into consideration different aspects such us the liberalization of education. We believe this effect of liberalization and the subsequent opening of education will represent this decade's true revolution in education.

*

How could a university from Romania, offering classic courses, compete with the offer that can be rapidly accessed online from Harvard or any other top university? [11] Faced with these new challenges, schools, high schools and universities will have to reconsider their strategies and remain competitive [10]. One solution might be offering own MOOC courses with credits and

MOOCs as part of degree programmes. Also the search for business models – and all the associated sub-issues of scale, sustainability monetization [14], accreditation for MOOC learning and openness. MOOCs are heading to become a significant and possibly a standard element of credentialed University education, exploiting new pedagogical models, discovering revenue and lowering costs [12].

Secondly, we should note the professional mobility, developing competencies specific to the knowledge society, as well as making people aware of the importance of lifelong learning and training, raising self-esteem and belonging to learning and practice communities [13].

Thirdly, specialists are working on a formula of continuous training by using MOOC courses in order to improve educational policies at national level, which we hope will increase the quality of teaching/learning [15].

Thus the results of such recommendations can be used for a broad range of new researches, such as: a) creating opportunities for organizations, teachers and learners to innovate and develop new business and educational models; b) launching large-scale research and policy experimentations to test innovative pedagogical approaches, curriculum development and skills assessment; c) exploring how emerging tools for the validation and recognition of skills, such as 'open badges' or nanodegrees, can be tailored to the needs of learners; d) testing digital competence frameworks and self-assessment tools for learners, teachers and organizations; e) supporting teachers in acquiring a high level of digital competences and adopt innovative teaching practices through flexible training, incentive schemes, revised curricula for teachers' initial education and new professional evaluation mechanisms; f) adaptive learning technologies, learning analytics and digital games for learning, creating links with innovative entrepreneurs etc.[16]

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Teachers' Perspective into Higher Education and MOOCs in Romania

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Abstract

Our research is highly connected to open education, higher education, online resources and Massive Open Online Courses (MOOCs). We decided to see the opinion of Romanian teachers about the above mentioned areas. For this we created an online survey which was distributed over various media ways to teachers, mainly involved in higher education. The survey consisted of two big parts, the first regarding online educational resources and their use in education and the second was strictly connected to MOOCs (courses and platforms) and was run in the spring of 2015. In this paper we present what is the opinion of Romanian teachers regarding these technologies and we try to argue the importance and need of such technologies to be further developed and integrated into the Romanian educational system.

Keywords: Higher Education, Teacher, MOOC, Online Educational Resources

1 Introduction

Our team inside the Multimedia Centre inside the Faculty of Electronics and Telecommunication, part of the Politehnica University of Timisoara has been involved in research related to e-learning technologies for almost a decade (Ermalai et al, 2008; Ermalai et al, 2009; Ermalai et al, 2009; Dragulescu et al, 2012; Mihaescu and Vasiu, 2014; Mihaescu et al, 2014; Petan et al, 2014; Vasiu and Andone, 2014; Vert and Andone, 2014; Onita et al, 2015). We analysed the impact technology is having over Higher Education and how online resources can be integrated into existing curricula and teaching methods.

By online educational resources we understand all those tools, applications, files, media items, materials that are being created and/or used in an educational purpose on the online medium. We believe that they include open educational resources but are not limited to them.

MOOCs are a trending technology of the past years, standing for Massive Open Online Courses (Daniel, 2012; Downes, 2012; Siemens, 2012; Belanger and Thornton, 2013). MOOCs have been used either as independent platforms with courses created by universities, educational institutions, companies and even independent teachers, or as a tool inside the traditional or flipped classroom concept (St Kolowich, 2013).

There has been much discussion regarding the influence MOOCs are having over higher education and about the lack of instructional design of some of the most popular platforms (Holton, 2012; Grover et al, 2013). We wanted to see the perspective of Romanian teachers regarding all these aspects.

2 Methodology and research questions

Our method of satisfying our curiosity was that we constructed an online survey for teachers involved in education.

The questions that we were looking answers for were:

- Did Romanian teachers use Online Educational Resources? In what way have they used them? What is their opinion about them? Did they also create such resources?

- What are the strong and weak aspects of Online Educational Resources?
- Did Romanian teachers use MOOCs? What type of MOOCs?
- What is their opinion about MOOCs in respect to their structure, design and educational aspect?
- Have they any desires for some items in a course page interface?
- What are the advantages and disadvantages of MOOCs?
- Did the teachers use MOOCs in their courses? Did or would they recommend MOOCs?
- Did Romanian teachers develop MOOC materials?

Our objective was to understand the necessity of the development of Online Educational Resources and MOOCs in Romania.

The survey was distributed via the educational platform of the Politehnica University of Timisoara, the Virtual Campus (https://cv.upt.ro), e-mail and social networks.

We used Google Forms to create the survey and we have built different types of questions: Single choice, multiple choice, choose from a list offered by us, text field, scale, grid. We have addressed to the teachers instructions and a copyright agreement before completing the survey.

3 Our Results

3.1 Respondents background

Our research planed to find out the medium where our respondents are teaching. 90% of them are teaching in universities, 8% are in the training business, 2% are in private education and 2% are teaching in pre-university systems.

Regarding their age, 35.6% of the respondents are between 31 and 40 years old, 26% are between 51 and 60 years old, 22.1% are between 41 and 50 years old, 9.6% are between 61 and 70 years old, 5.8% are under 30 and one person is over 70 years old.

62.5% of the teachers are male and 37.5% are female.

As most of our network is from Timişoara, 83.7% of the respondents are from this city. Other numbers include 3.8% from Bucharest, 2.9% from Braşov and 1.9% from Cluj-Napoca.

The majority of 78% of the respondents are from our Alma matter, Politehnica University Timişoara. 2.9% were from the West University of Timişoara and 2.9% were from the Transilvania University of Braşov.

3.2 Online Educational Resources

When asked if they have ever used online educational resources, our participants answered with “yes” in an 83% proportion. 49% of the teachers also created such resources. Only 3% have not used them and there was not a single teacher that had not heard of online educational resources before.

Next, we asked our respondents to rate the usefulness of OERs from their point of view, on a scale from 1 to 5, 1 meaning not very useful, and 5 meaning very useful. The majority, 47.1%, opted for 5.

Further, we inquired about the role OERs should have in our educational system. An almost unanimity of 93.3% of our participants indicated that these resources should coexist and complete the existing traditional and current ways of teaching.

Interesting feedback was received asking what parts of the educational process could happen online, as seen in the figure.

We also asked people what online resources they think are useful, again giving them the possibility to choose more than one option. 82.7% of the teachers think that presentations (probably with slides) are useful and 78.8% think that videos help. 70.2% of the respondents think that graphs and schematics are useful and 76% chose images are helpful resources. Text was chosen by 71.2% of the participants and virtual laboratories by 48.1%. Audio resources are useful in the opinion of 42.3% of respondents and test resources are useful for 39.4% of them. Only 26% of the teachers think that the glossary is a useful educational resource.

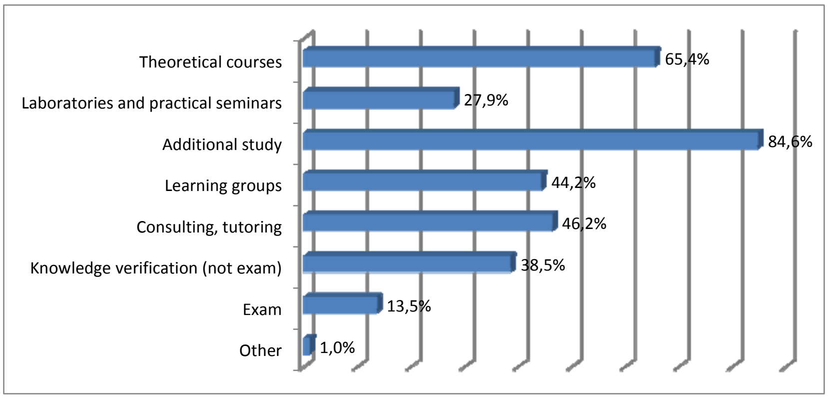

Figure 1. **What parts of the educational process could happen online?**

However, Online Educational Resources do not necessary mean Open Educational Resources, so we wanted to see the teachers' opinion about sharing resources created by them. A majority of 58.7% has already shared their own resources with others and another 23.1% would share them free. 26% of the respondents would only offer part of their resources and 7.7% would offer them for a fee. 12.5% of the respondents do not know if they would offer their resources, probably because our question was not specific in what way to offer the resources. A surprising 1.9% of the participants would refuse to share their work because other people would steal it away. 1% would not share their work because they don't have time and 1% won't do it because they don't manage the technology.

Next, people were asked about the advantages of online educational resources. 79.8% of the teachers who answered think that the facts that these resources can be access anywhere and anytime are advantages. 78.8% of them think that the easiness of access is also an advantage. 54.8% chose as an advantage the fact that students can learn in their own rhythm and 44.2% said that the videos are an advantage. The course materials are considered an advantage by 36.5% of our respondents and the freeness of the resources by 33.7%. 27.9% of the participants think that it is easier to communicate with more "virtual" colleagues. Only 10.6% think that online resources are easier to understand than traditional ones and a surprising number of 5.8% of the teachers would opt for resources because they will not need to directly interact with students anymore.

We also inquired about the disadvantages of online educational resources and got some interesting answers. 85.6% think that the lack of direct interaction between tutor and student is a disadvantage. 19.2% of the teachers think that the students cannot learn by themselves and 14.4% think that online resources are harder to understand than traditional ones. 8.7% think that the price is an issue and only 1.9% thinks that online resources are hard to access. Other disadvantages that we received were: "hard to elaborate", "lack of quality evaluation", "ambiguous authority of generation of online resources", "there is no flexibility in the adaptation of the message depending on the students reaction", "lack of performant computers", "no learning rhythm", "exchange of information unilateral and limited", "lack of time to get used with the resources", "illiteracy".

3.3 MOOCs

We wanted to be more specific and find out the relationship of our teachers with Massive Open Online Courses (MOOCs). 30.7% of the teachers have used a MOOC, 53% of which think that

MOOCs are good, 41% think they are very good and 6% think they are not interesting. 46.2% of the participants did not use a MOOC but would like to try it. 18.3% of them do not know what a MOOC is and 4.8% do not intend on ever using a MOOC.

We asked the ones who used MOOCs about the platforms they used and got the following results. 66% of our respondents used Coursera and 31% EdX. 29% of our participants followed a MOOC on Udacity and 14% did this on FutureLearn. 11% of the teachers used Udemy and 9% used iversity. 6% of our participants followed a MOOC on MiriadaX.

Our next step in our research was to find out how much did the teachers appreciate different aspects of the online course that they followed on the MOOC platform. We asked them to rate from one (not good) and five (very good) a list of particularities of an online course.

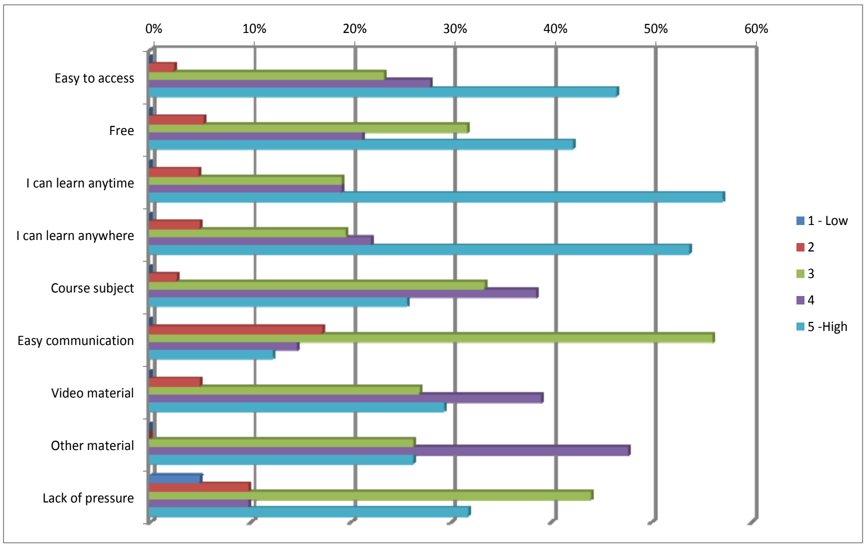

Figure 2. **Rate of different course aspects**

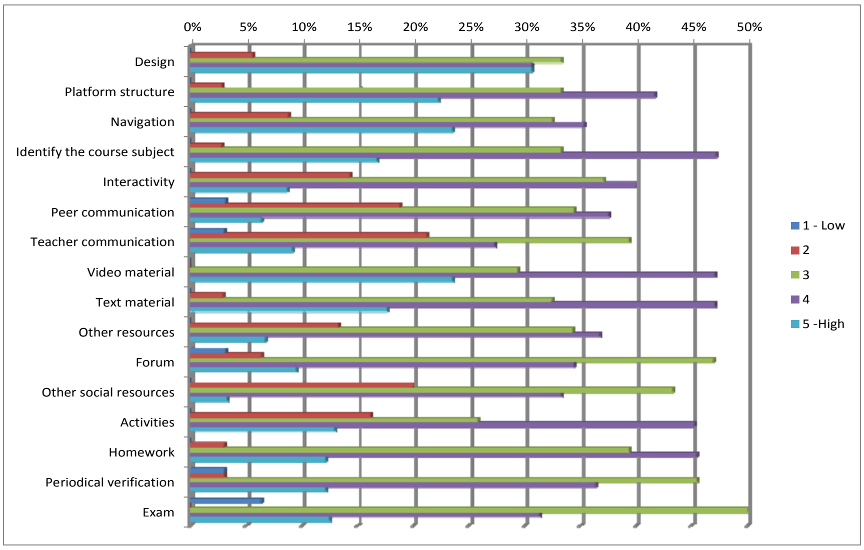

Figure 3. **Rate of platform aspects**

We were also interested about the opinion of our respondents regarding the characteristic of the platforms that they followed MOOCs on. Again, we asked them to scale from 1 to 5. The results can be seen in Figure 3.

After rating things that are already on a MOOC, we asked our survey participants to tell us what they would like to find more on a MOOC. 65.9% want more interactivity with the teacher and 52.2% want more video material. 50% of the participants feel the need of more resources and extra information. 31.8% feel there is need for more interactivity with fellow students and 29.5% want more activities. Also 29.5% of respondents want more actual and correct information. More text is wanted by 18.2% of participants and 13.6% want more social links (Facebook, twitter, LinkedIn, etc.). 11.4% of the teachers want other course topics and 9.1% want to better know their fellow colleagues. Other answers we got include “more interactivity with the platform”.

When asked if they used MOOCs in their classes, 87.4% of the teachers denied this and 12.6% said they have used MOOCs in their own classes. We then asked them in what way had they used MOOCs in their classroom. We got a few responses, which include “use of applets and video material”, “flipped classroom concept”, and “blended learning”.

We wanted to see in what areas were MOOCs used and followed. 78.8% of the respondents chose the engineering field, 6.1% chose economic and another 6.1% chose socio-human sciences. Another 6.1% used it in mathematics and 3% of the respondents used MOOC in personal development area.

When asked if they recommended MOOCs to their students, 56.3% of the respondents said yes, 42.2% said no and 1.6% said that MOOCs are not adequate for education.

83.8% of our participants said that they did not develop MOOC courses and materials. However, 16.2% said they did develop such materials but after asking them to detail this, we understood that they either did not understand the question or made confusion about what MOOC resources are.

4 Conclusions

After carefully analysing the results we can conclude the following. Romanian teachers are very aware of online educational resources and many of them have also created such resources. A vast majority of 78.9% of respondents consider OERs to be at least useful. The opinion that they should be used in a symbiosis with traditional learning is almost unanimous. More than half of the teachers think that extra study time and theoretical courses could happen online and almost all agree that the exam should not. The most useful resources are considered to be slides, videos, graphs, images and text. The advantages are, in the Romanian teachers’ opinion, the access anywhere/anytime aspect and the learning in one’s own rhythm. The most mentioned disadvantage was by far the lack of direct interaction between the tutor and the student.

As to what MOOCs are concerned we found that only one third of our respondents used a MOOC at least once, but they are very curious about it. The most used platforms by Romanian teachers are Coursera, EdX and Udacity. The most appreciated aspects of a MOOC course are the “learn anytime/anywhere” aspect and the easiness of access. The least appreciated is the communication aspect. In the Romanian teachers’ opinion the most appreciated particularities of MOOC platforms are the video and text materials together with the structure and design. The least appreciated aspects are the communication between peers and between the teacher and the students. The teachers feel there is more interactivity needed inside MOOCs. Even if only a few teachers used MOOCs in their own classes, around half of them have recommended MOOCs to their students and some even developed MOOC like material.

More complete results will be available in a PhD thesis published in the upcoming months. Further research is required, as the results could be biased by the vast majority of respondents coming from the same institution, UPT. Also, after the development of Romanian MOOCs it would be interesting to compare similar survey results conducted then to the ones from this paper.

5 Acknowledgment

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Exploring Excel spreadsheets in the teaching and learning of certain concepts of Statistical physics and Thermodynamics

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Abstract

This paper demonstrates the way in which Excel spreadsheets can be explored in the teaching and learning of certain concepts of Statistical physics and Thermodynamics. It describes two didactic tools built with the help of spreadsheets in order for students to understand the model of the ideal gas more easily. The first instrument assists in the analysis of the Maxwell-Boltzman distribution according to the model of the speeds for an ideal gas, emphasizing certain particular aspects. The second instrument assists in the analysis of the isothermal process of an ideal gas and demonstrates the calculus relation for the work using the graphic interpretation of these measures within the pressure-volume diagram. Through the combined integration of the two tools in Physics lessons, students can grasp concepts such as distribution according to speeds, isothermal transformation and work in Thermodynamics. Also, by numerically calculating the work with the help of the facilities offered by the spreadsheet, students take an important step forward towards the understanding of a key concept of mathematical analysis, i.e. the definite integral.

Keywords: Maxwell-Boltzmann distribution, isothermal transformation, work in thermodynamics, Physics Education.

1 Introduction

The teaching and learning of Thermodynamics and Statistical physics constitute a research subject in Physics education. The literature presents articles analyzing the difficulties met by students in the study of Thermodynamics and Statistical physics and suggesting various solutions for an efficient approach of this Physics domain.

The investigation of students' understanding of the first principle of thermodynamics has shown that they do not frequently manage to differentiate between the concepts of heat, temperature, work and internal energy. The authors suggest that the incorrect interpretation of simple microscopic models can affect the understanding capacity of the macroscopic phenomena (Loverude et al, 2002). In order to guide students in solving thermodynamics problems, there have been designed applications in the C # language for the study of simple transformations of the ideal gas and for the analysis of basic thermodynamic cycles. With the help of these tools, students can gain a better understanding of the principles underlying thermodynamics and the way in which these principles can be used in solving problems (Liu, 2011).

In the solving of thermodynamics problems spreadsheets have been promoted as tools that can be developed by students instead of other specialized programs (Sandler, 1997). The utilization of Excel formulas together with the programming means Visual Basic for Application (VBA) has generated models of thermodynamic systems and has shown the effects of the change in the input parameters on the final results (Caretto et al, 2005). Also, it has been demonstrated how the set of Solver functions from the Excel spreadsheet can be used to calculate the thermal balance for different substances known by minimizing the Gibbs energy. The results have been compared with those obtained by using a program written in the Fortran language finding a satisfying concordance (Lwin, 2000). The graphic facilities of spreadsheets have rendered the construction of the phase diagrams for the binary systems Al-Zn and Li-Mg (Tomasini, 2014) and demonstrated how various aspects related to the Fermi-Dirac distribution can be clarified (Sharma and Ahluwalia, 2012).

In the context of the classroom utilization of spreadsheets, the paper describes two Excel didactic tools designed for the teaching and learning of certain concepts specific to Statistical physics and Thermodynamics.

The former allows the graphic visualization of the Maxwell-Boltzmann distribution according to the module of the speed for an ideal gas. We have graphically highlighted the typical speeds of the gas such as the most probable speed, the mean speed and the root mean square speed, together with the corresponding values of the distribution. The distribution according to speeds can be analyzed comparatively for different gases at different temperatures. In particular, there is the possibility to visualize the overlapping of the distribution curves according to the speeds of the same gas for three different temperatures or for three different gases at the same temperature.

The latter allows the analysis of the isothermal process for an ideal gas. We have represented the isothermal curve in pressure-volume coordinates highlighting the initial and final states of the process and calculating the work changed by the gas with the external environment. Moreover, this tool helps demonstrate the calculation relation of the work in the isothermal process using the geometrical interpretation of this measure in the pressure-volume diagram. Thus, we have a comparison between the value of the work calculated analytically with the value of the work calculated numerically using the trapezoidal rule in the evaluation of a definite integral.

2 Organization of spreadsheets

The structure of the tools presented in this paper is similar to that of other tools described by the authors which explore the facilities of Excel spreadsheets in the process of teaching and learning of Physics (Grigore et al, 2014; Grigore et al 2015). The main spreadsheet of each tool comprises the sections "Data input" and "Results", plus the area of the associated graph. For each measure of the two sections we state the unit of measurement. We shall further describe how the mode of employment and the characteristics of each tool.

Figure 1 renders the main spreadsheet of the tool for the analysis of the Maxwell-Boltzmann distribution according to speeds.

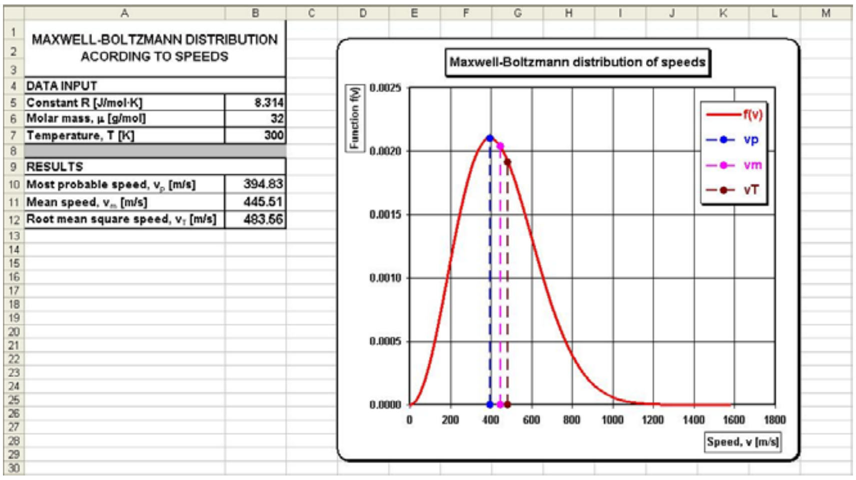

Figure 1. **The main spreadsheet of the tool for the analysis of the Maxwell-Boltzmann distribution according to speeds**

The measures introduced in the "Data input" section are: the universal gas constant R in cell B5, the molar mass μ in cell B6 and the gas temperature T in cell B7. In the "Results" section we calculate the most probable speed v_p in cell B10, the mean speed v_m in cell B11, the root mean square speed v_T in cell B12.

In order to perform the calculations in Excel we have used the following cell names: in the main spreadsheet Constant_R for cell B5, Mass_Mol for cell B6, Temperature for cell B7 and in the sheet for intermediary calculations, Constant_K for the cell in which we calculate Boltzmann constant k, and Mass for the cell in which we calculate the mass of the gas molecule, m_0.

To perform the calculations leading to the analytic and graphic results from the main spreadsheet we have used the relations known in the literature (Serway and Jewett, 2013). For example, the distribution function according to the module of the speed is given by:

$$f_{(v)} = \left(\frac{m_0}{2\pi kT}\right)^{3/2} 4\pi v^2 e^{-\frac{m_0 v^2}{2kT}} \qquad [1]$$

The graph from figure 1 renders in a red line the curve of the distribution function according to the module of the speed. It also renders the typical speeds of the gas with the values corresponding to the distribution in the dotted line segments colored differently. Thus, the most probable speed is highlighted in blue, the mean speed in pink and the root mean square speed in brown. The source table of this graph was drawn through a procedure used by the authors in other papers as well (Grigore et al, 2015). Thus, in column A of the table we have generated an increasing series with a unit step with which we further generated in column B the values of the speed. To generate the values of the speeds we have used a speed quantum equal to the 100^{th} part of the most probable speed v_p and the value interval of the speed was fixed between 0 and $4v_p$. With the start values in the 4^{th} row of the spreadsheet, we have transcribed relation [1] in Excel in cell C4 as follows:

"=(Mass/(2*PI()*Constant_K*Temperature))^(3/2)*4*PI()*B4^2*EXP(-(Mass*B4^2)/(2*Constant_K*Temperature))''.

Propagating the Excel formula along column C, there have resulted the values of the distribution according to the module of the speed. The source table of the graph in figure 1 also contains supplementary rows and columns to graphically highlight the velocities v_p, v_m, v_T.

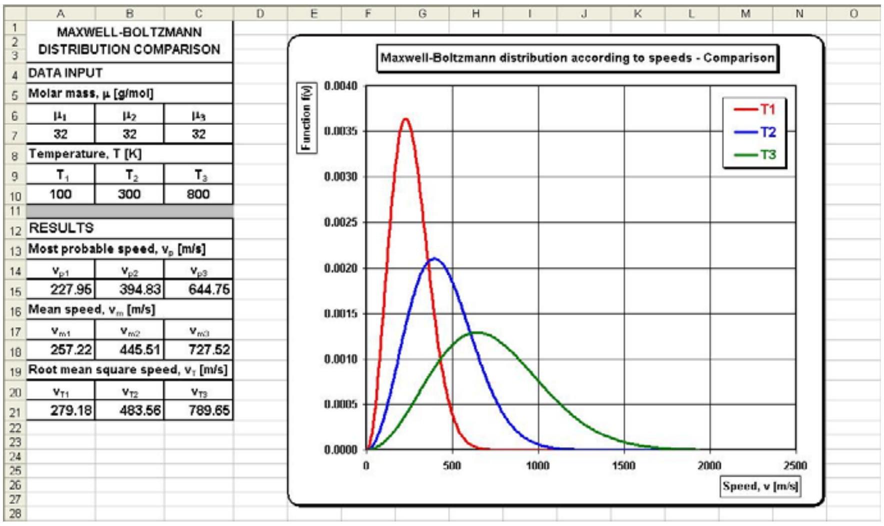

Figure 2. **Secondary spreadsheet for the comparative analysis of the distribution according to speeds. Comparison between the distributions of speeds of the same gas at three different temperatures**

Figure 2 presents the spreadsheet with the comparative analysis for the distribution according to speeds when we have the same gas at different temperatures. Considering oxygen as an example of gas, O_2, we have introduced in cells A7, B7 and C7 the molar mass $\mu_1=\mu_2=\mu_3=\mu=32$ g. In cells A10, B10 and C10 we have introduced three different temperatures, namely, $T_1=100$ K, $T_2=300$ K, $T_3=800$ K. In the graph alongside the input data it can be observed how the distribution curve modifies according to the speeds with the temperature. As the temperature rises, the maximum value of the function f(v) decreases and the distribution curve moves towards greater values of the speed.

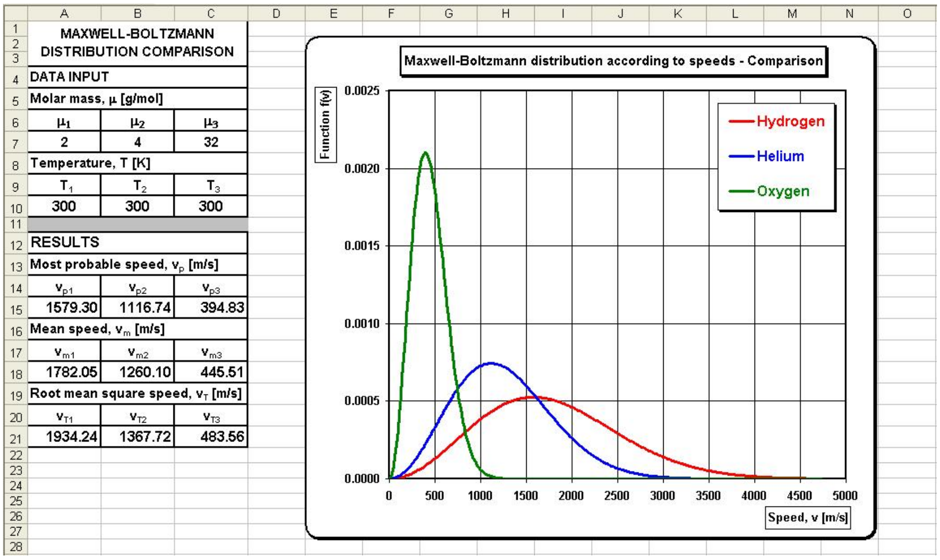

Figure 3. **Secondary spreadsheet for the comparative analysis of the distribution according to speeds. Comparison between the distributions according to speeds for three different gases at the same temperature**

Figure 3 renders the spreadsheet with the comparative analysis for the distribution according to speeds when we have different gases at the same temperature. Considering as examples of gases hydrogen, H_2, helium, He, and oxygen, O_2, we have introduced in cells A7, B7 and C7 the molar masses $\mu_1=2$ g, $\mu_2=4$ g, $\mu_3=32$ g. In cells A10, B10 and C10 we have introduced the same temperature $T_1=T_2=T_3=T=300$ K. In the graph alongside the input data it can be observed how the distribution curve modifies according to the speeds together with the molar mass of the gas. It is checked that with the growth of the molar mass, there is a growth in the maximum value of the function f(v) and the distribution curve moves towards smaller and smaller values of the speed.

The source tables of the graphs from figures 2 and 3 have been drawn in an analogy with the source table of the graph in figure 1. To generate the values of the speed in this case, we have used a speed quantum equal to $v^*/100$, where v^* represents the maximum of the most probable speeds of the three gases. The interval of values is between 0 and $3v^*$. With the help of relation [1] we have calculated the distribution function f(v) for the three gases, adapted to the new input data from the secondary sheet.

Figure 4 renders the main spreadsheet of the tool for the analysis of the isothermal transformation of the ideal gas. The organization of the main spreadsheet of this tool is similar to that of the tool previously presented for the analysis of the Maxwell-Boltzmann distribution according to speeds for an ideal gas.

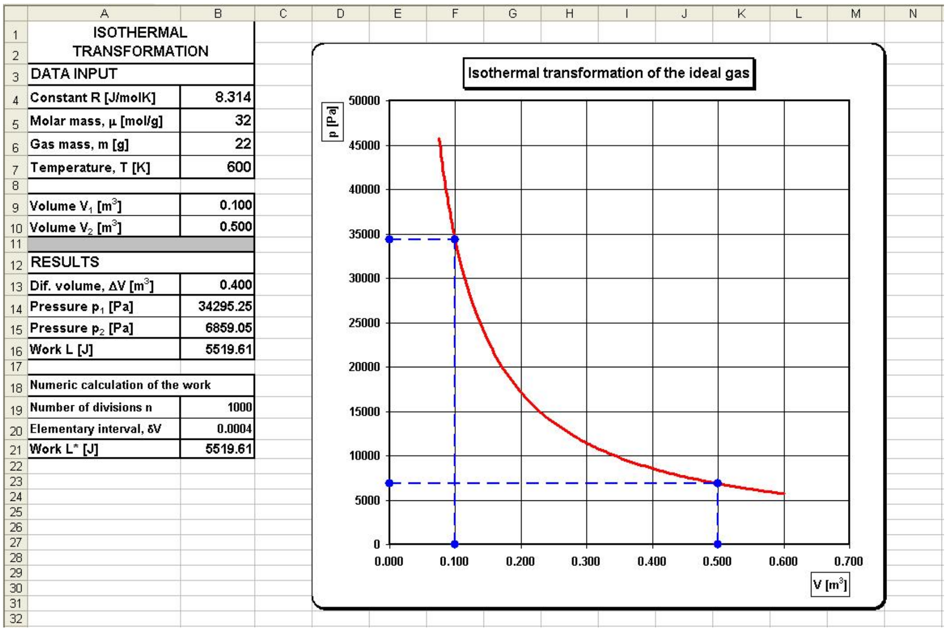

Figure 4. **The main spreadsheet of the tool for the analysis of the isothermal transformation of the ideal gas**

In the section "Data input" we introduce the following measures: the universal gas constant R in cell B4, the molar mass μ in cell B5, the mass of the gas m in cell B6, the temperature of the isothermal process T in cell B7, the volume of the initial state V_1 in cell B9, the volume of the final state V_2 in cell B10. In the section "Results" we calculate the difference of volume throughout the process ΔV in cell B13, the pressure of the gas in initial state p_1 in cell B14, the pressure of the gas in final state p_2 in cell B15, the work done L in cell B16.

To calculate the pressure in the initial and final states we have used the equation of state of the ideal gas and for the analytic calculation of the work the following relation (Serway and Jewett, 2013):

[2] $$L = \int_{V_1}^{V_2} p_{(V)} dV = \frac{m}{\mu} RT \ln\left(\frac{V_2}{V_1}\right)$$

The domain A18:B21 from the "Results" section is reserved for the numeric calculation of the work using the geometric interpretation of this measure in p-V coordinates. In cell B19 we introduce the number of divisions n, in which the interval $[V_1, V_2]$ is divided, in cell B20 we calculate the elementary interval $\delta V=(V_2-V_1)/n$, while in cell B21 we calculate the work L*, as the area below the isothermal curve corresponding to the interval $[V_1, V_2]$. The value of the work calculated numerically in cell B21 is compared to the value of the work calculated analytically according to relation [2] in cell B16.

The associated graph from the main spreadsheet renders the isothermal curve of the process in the red line and highlights the pressure-volume pairs of values corresponding to the initial and final states through the segments of dotted line colored in blue.

For the numeric calculation of the work we have drawn in a secondary sheet a table similar to the source table of the graph from figure 4. In column A of the table we have generated an increasing series with a unit step from 0 to n=1000. In column B we have generated the values of the volume from the start value V_1 with the help of the series from column A, the volume quantum being determined by n, the number of divisions in which the interval [V_1, V_2] is divided. In column C we have calculated the pressure corresponding to each value of the volume from column B utilizing the equation of state. To perform the calculations we have introduced the following names of cells and domains: Pressure_1 for cell B14, Pressure_2 for cell B15, Delta_V for cell B20 in the main spreadsheet and Domain_P for the domain in which we calculate the values of the pressure in column C of the table from the secondary sheet. Applying the trapezoidal rule for the numeric evaluation of a definite integral, we have written the following Excel formulas in cell B21 of the main sheet:

"=(SUM(Domain_P)-(1/2)*(Pressure_1+Pressure_2))*Delta_V".

It can be observed that the result in cell B21 coincides with the result from cell B16, L*=L. By modifying the number n of divisions of the interval [V_1, V_2] and correspondingly redrawing the source table, the effect on the result displayed in cell B21 can be observed. It is thus checked that with the increase of n, the value of the work in cell B21 tends towards the value of the work in cell B16.

4 Conclusions

Students' participation in the creation of the didactic tools described in this paper can be beneficial for the understanding of the model of the ideal gas. The classroom utilization of the respective tools represents a conclusive example of how to emphasize the facilities offered by the Excel program.

The first tool helps students clarify aspects connected to the Maxwell-Boltzmann distribution according to speeds of the ideal gas and rapidly observe the effect on the distribution function when modifying the input data. Thus, the change in the distribution can be studied according to speeds when the temperature and/or the molar mass of the gas changes.

The second tool facilitates students' understanding of the isothermal transformation of the ideal gas and clarifies certain aspects connected to the concept of work in thermodynamics. Thus, this tool offers students an alternative demonstration for the calculus relation of the work in the isothermal transformation of the ideal gas. This demonstration based on the geometrical interpretation of the work within the pressure-volume diagram employs the data manipulation capacity in the spreadsheet. The numeric calculation of the work represents an important step towards the assimilation of a key concept of mathematical analysis, namely the concept of definite integral. Students can better observe the manner in which the knowledge transfer between Mathematics and Physics takes place.

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Interactive ITC Applications for Technological Education - "Energy" Module

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Abstract

Technological education is a different kind of education, since it manages to channel the students beyond conventional frontal learning. The paper refers to the educational process in the secondary education, at the 8th grade Technological education courses. The electric circuit in a house is the most important piece of the utility network. The authors create an original educational software which is made of two main components: one informative part that is directly taught to the whole class as a didactic movie that refers to the knowledge and abilities accumulated by the students in the module „Energy", and the second one, that is an interactive part used to apply the information by individual or collective activities that can be verified and measured. This interactive part allows the students to make a draft regarding the electrical circuits of plugs and light using the specific symbols of a given plan of a house. Unlike academic learning, this process allows the teacher to see the students in different ways, working individual, in pairs, and in groups. The role of the teacher is to provide feedback, comments and reinforcement. The ICT products creates a new approach that places the student at the center of doing, allowing him to undergo a process of developing independent thinking and finding personal solutions.

Keywords: Technological education, Educational software, Interactivity

1. Introduction

Technology is being modified and evolving continuously. Everyday living is becoming technologically more and more complex even if the world is more fragile that ever, with crises and conflicts wherever you look. The society we live in is one where the new technologies of information and communication force us to develop a new vision on the learning process and teachers need to adapt and prepare their students accordingly. As Bruner said, "technology creates a demand for more and better teachers" (Bruner, J., 1962, p.84). Nowadays, in schools there are more students with flexible and user-friendly hardware and more teachers and educational managers who recognize the value and utility of ITC than ten years ago (Vlada et al, 2009; Toma et al, 2009). As a result, the students and the teachers understanding of the nature of learning has evolved.

Through Technological education learners have to be encouraged to deal with the problems in their real or virtual environment. Each Technological education lesson in gymnasium has to be authentic, in the sense that what the student is learning has meaning to him or her as an individual, or as a member of a different formal or informal groups.

2. The Problem

The signals that an energetic crisis could have the effect of reducing technology rhythm of development are more and more frequent. The school could not ignore this reality in which the biggest efforts refer to the development of the clean energy technology programs. Energy is a fundamental scientific concept which, because of its personal, economic and social importance, is introduced in curriculum from the early stages of education (English Curriculum – Nuffield Primary Science, 1995). In Romania, ”Energy” has been included as a compulsory module of the Technological education subject for gymnasium students of the 8th grade in 1992.

The specific competences that are to be developed at students attending ”Energy” module are primarily the following:

- the usage of the concepts, symbols and conventional marks that refers to energy in order to solve current problems;
- the rational and safe usage of the different forms of energy in the daily activities;
- making models of some components of the system of producing, transport and distribution of the electric energy to different consumers (Fig. 1).

Figure 1. **Students composing the scheme of „Transport and distribution of the electric energy”, Băiculești School, Arges County**.

- making suggestions how to prevent the negative effects that the producing, transport and distribution of the electric energy have on the environment and on the quality of life;
- using ICT to search information and to make drafts of simple electric circuits.

A lot of teachers report that the hardest specific competence to be developed at the students is the last one, the main objective of the lesson "Electric circuit in a house": the 8th grade students have problems in reading and understanding the electric scheme of their house, in presenting the significance of the light and of the plugs circuits, and especially to design an electric scheme of a house.

3. Methodology

Hypothesis: It is possible to support students' learning of this specific competence by creating and integrating in lessons ICT educational resources used either as instruments or ways of instruction or as learning environments.

Products: During the 2014-2015 school year, there have been created two auxiliary curriculum of educational soft type, two programs "specially projected to solve didactic/educative tasks or problems through the computer assisted technology "(Adascalitei and Brasoveanu, 2003), for the module "Energy". The computer products are represented by a didactic movie and an interactive application.

The stages in the educational software making have respected specific operations in the didactic and computer projection of a curricular auxiliary.

The beneficiaries: The main receivers of the computer products created are the students from the 8th grade. By using the program, the students are not only attracted but also engaged in a virtual activity of creating an electric energy network, with precise tasks, that respects some rules of placement and conventional marks in conditions of cooperation with the other colleagues and of assuming roles and responsibilities. Another category of receivers is represented by the Technological education teachers. They could integrate curricular auxiliary created in the lessons at the module "Energy", at the 8th grade.

Implementation: The educational software were integrated in the lessons at the module "Energy". The sample of the research consisted of 75 students, who were attending 8th classes in four public rural secondary schools in the Arges County. The schools selected were those in which one of the authors teaches in the subject. The students participating in the study had already completed their 13th year of age. According to the national curriculum, the topic of energy had not been discussed in any of the classes prior to the study.

4. Results and Discussions

The development and the use of an educational software can be view as ”an extension of the art of teaching” (Bruner, J., 1962, p.83).

An ICT application is not the answer for Technological education lessons unless it reflects learners' needs and suits their environment. The projection of an educational software consists, first of all, in the definition of the receivers and the specific contribution that it could have for the development of those competences.

The stages in the educational software making have respected specific operations in the didactic and computer design of a curricular auxiliary, as it follows:

4.1 The Didactic Design

a) Identification of the domain of making the educational software (subject, learning unity, the lesson or lessons in which they will be integrated in as an educational resource). Realizing that the 8th grade students have problems in reading and understanding the electric scheme of their house, the significance of the light and of the plugs circuits, and especially to design an electric scheme of a house, the authors selected the lesson "Electric circuits in a house". It was considered that using an interactive application "How to design the house electric installation", the electric scheme could be easily made thus allowing the student to make it in a personal way and even to modify it when he wants, having at his disposal enough elements to make it from the beginning. For the light circuit, red symbols are used and for those of plugs, blue symbols are used. This way, on a house plan can be made the schemes of the both circuits: of light and of plugs. When the electric schemes are finished this can be verified, saved or printed, after case.

Having in mind that before starting the work task it should be made a review of the knowledge and abilities of the students so that they could see the role of an electric circuit in a home, the authors consider necessary to make a didactic movie that, on one hand, to do a short review of the key concepts at the module "Energy" and, on the other hand, to present the instructions how to do the work task during the interactive application.

b) Defining the finalities of the lesson/lessons in which that software will be used:

The specific competences to be developed at students by using the software are: the usage of the concepts, symbols and conventional signs referring to energy in order to solve current problems; the responsible usage of digital/multimedia resources when searching information to make simple electric circuits.

The specific task for students consists in the virtual creation of an electric circuit in an apartment/house having at their disposal the apartment's plan and specific symbols for the electric network by:

- establishing the destination/functionality of every room in the house;
- using symbols specific for the electric circuits in a house/apartment;
- placing these elements according to the room's destination/purpose and technical known rules.

c) Share the contents in pages or instruction parts:

For the subject "The electric circuits in a house", the software has two main parts:

- One informative part, a didactic movie with a pleasant music background: "Electric circuits in a house". The didactic movie was made in such way to follow the contents of the Technological Education curriculum in the order in which they were taught in class and in the natural order of the technological processes involved: the concept of "energy"; energy forms; sources of energy; the electric energy (producing, transport and usage); electric circuits in a house.

The musical background was chosen in such way as to ease the process of remembering and fixing the knowledge learned.

The content of the movie should be read individually by every student. At the review, the written commentary could have been read out loud by a student and explained by the teacher. When the information requires a detailed explanation, the movie could be reload and paused, if needed.

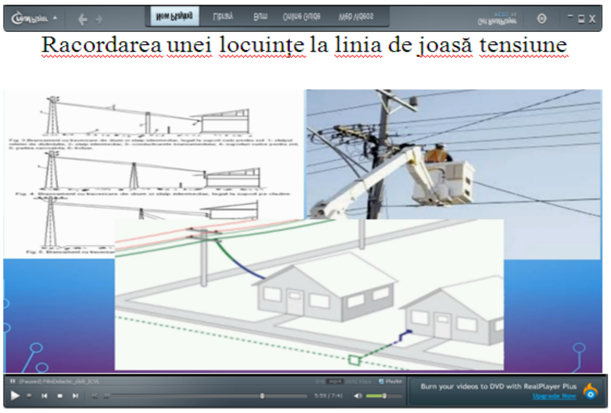


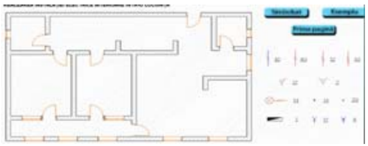
Figure 2. **Screen captures from the Didactic movie "Electric circuits in a house".**

- One interactive part necessary to fix the information using individual activities that will be verified and appreciated. This interactive part allows students to practice the process of making an electric circuit in an apartment, on a given plan of it.

The content of the task, advice concerning the way in which they should work, remarks made to the rules and evaluation criteria are presented to the students by the teacher but also by the computer product on every computer on which 1-2 students work (Fig. 3).

LET'S DESIGN AN ELECTRIC CIRCUIT!

1. Establish the destination of each room of the house with a plan like this:



2. Design the electric circuit using the house plan presented on the computer display. Try to follow the right paths (the best) you decide. You have to use a symbol from the right side of the plan taking into account, on one hand, to position it in the right place of the rooms, and on the other hand, to have enough elements left.

How to work: Click the left button of the mouse on the symbol you want to use and after that you pull it (the left button of the mouse is pushed and the mouse is moved on the pad), to move that symbol in the right position. When you want to rotate a symbol, select it with the left button of the mouse and after that you scroll it (the mouse' wheal).

Attention! The plugs and switches are not allowed in the bathroom! These should be fitted on the entrance wall of the bathroom. The plugs from the kitchen and those from the bathroom entrance will need to have electric ground!

Working time: 30 minutes.

Evaluation will be made according to criteria: the existence in every room of lighting objects and of plugs; the placement of the plugs and switches according to the room characteristics (the position of the door, the position of the electric appliances to be used); the symbols used on different portions of the electric appliance path.

Figure 3. **Instructions for solving the application**

Concretely, the students are given a plan of the house and a certain number of specific symbols from the electric domain (Fig. 4). The students' tasks are to establish the function/destination for each room represented on the house plan and to make the electric circuits of that house, using specific symbols and respecting some technical requirements.

Figure 4. **Interactive application: "How to design the house electric installation".**

The great advantage of this application is represented by the ease of which the scheme could be made and modified, allowing students to obtain more versions, which can become the object of a study case with the students (Fig.5). At the end, it can be established the efficiency of different schemes realized taking into account the number of elements left unused (the large number of elements left in the using conditions of the same number of lightning and plugs, it could be an indicator of the efficiency of the scheme).

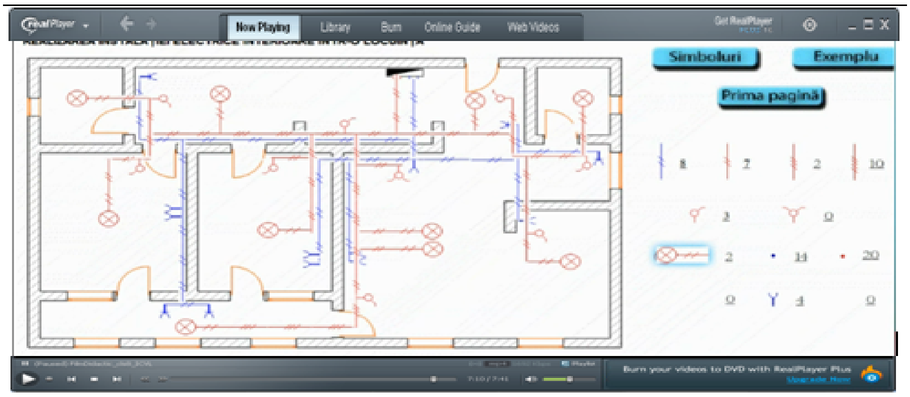


Figure 5. **A possible solution for solving the application**

d) Choosing the didactic strategies (methods, material resources, organization forms, evaluation). In this case were used as methods: case study, discovery, learning using the computer, the exercise; as material resources: computers, textbooks, scientific books, representative images from scientific magazines or web pages. Also different forms of organization have been used: individual, on groups and frontal. The evaluation forms were: self-evaluation (every student can evaluate his " project" by comparing it with a given example), colleague evaluation and teacher evaluation on the next criteria: the correct identification of the rooms, the correct placement of the symbols having in their disposal and the accuracy of the final product.

4.2 The Computer Design

a) The realization of the didactic movie

Using Microsoft Office Word, the basic information was organized, selected and written.

To obtain the house plan, was used the application-program ArchiCAD to create a virtual house in 3D. Images 2D and 3D were print screened and were used not only in the didactic movie but also for the interactive part. Using Photoshop, the pages of the presentation-movie were created and numbered not only by inserting the written material but also by inserting the images, with special link to the bibliographic sources used.

The animation from the presentation's pages was created using Macromedia Flash 8. With Microsoft Office PowerPoint the application's pages were assembled with the musical background and then they were transformed into a movie (.mp4 format). To change the movie's form, Total Video Converter was used in order to be used on every computer (.avi format).

b) *Making the interactive application*

The interactive "Electric circuits in a house" was made with the help of Adobe Flash CS6 application. It had been take into account that the symbols and the house plan have to be made in such a way that, on one hand, to respect some proportions and, on the other hand, to be enough to fulfill the task. For the first page of the interactive application ArchiCAD application-program was used to create a virtual house in 3D. A print screen was taken to the 3D image to use it for the first page of the interactive application.

c*) Verify and correct the application*

To verify and correct the application experts from the Faculty of Engineering Appliances and the students from the 8th grade were involved. They have reported all their observations (mistakes and mismatches) and after that the corrections have been made.

d) Using the application

The conditions of the hardware and software resources necessary that the computer should fulfill are: the interactive application could be opened with any browser (Internet Explorer, Mozilla, Google Chrome etc.) on every computer on which Window 7 or the previous operation systems is installed and Adobe Flash Player 15. The software installation is made by copying it. It is recommended the use of a shortcut. The didactic movie can be opened with the help of: Windows Media Player, KMPlayer, BSPlayer, VLCPlayer, Nero Show Time etc.

5. Conclusions

The computer products described above were used in the Technological education classes, proving their pedagogical and motivational potential. The movie and the application were parts of the educational event named lesson, facilitate students' understanding of, and familiarity with simple electric schemes and allows students to create questions and explanations of their solutions, answer questions created by their peers, and provide comments to the feedback received.

The application provided immediate feedback to the student while he was **in** the act of learning. The students have participated with pleasure, they have given the interactive part aspect of a game, they have searched arguments to support their alternative solutions, they have referred to the norms of health accomplishment and of working protection, and to the norms of placing every part of the electric circuit. A lot of placing solutions brought discussions between colleagues that had to make the respective circuit.

The teacher discussed general aspects with the whole class and special aspects with every team of designers. Also the interactive application became the object of a contest between students teams, the teacher having the possibility to establish different levels of difficulty using two indicators: the complexity of the task and the time in which the students should make the electric circuit scheme on a given plan of a house.

Applications can be changed but this requires a lot of interdisciplinary teamwork, support and imagination. Collaboration with specialists in different domains, testing and updating the obtained products are also required. Concerning the didactic movie, lots of variants were created, different in contents (information, images), design or time, some distinctions being made by the information and images brought by students from the internet. The students strive to make the teacher use their idea and to get their colleagues appreciation.

The research highlights, as well, the necessity of reconsidering the Technological education curriculum, suggesting an interdisciplinary and multidisciplinary approach, with an integrated curriculum and proper training for the future teachers.

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Rethinking education through blogs

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Abstract

CREDIS is the acronym for the Department for Distance Learning of the University of Bucharest. This department was established in 1999, based on the university's Senate Decision. CREDIS activity is defined by new higher education study programs (BA and MA) especially designed for pre-service and in-service school teachers; a new BA study program (240 ECTS) focusing on "Information Technology"; new LLL programs (CISCO Networking Academy, Microsoft IT Academy, ECDL), all with the main purpose of providing the best learning tools and opportunities to our students by always trialing different types of digital technology and exploring its potential for learning. The main purpose of this study is to present a new way of educating students'through blog. It will be presented a case study developed by professor Bogdan Logofatu in which he used blogs as an e-learning tools for evaluation, for recording the learning process and also for disseminating the outputs of the teaching process. Additionally this paper will underline the role of the blog in extending students' knowledge and making connection between what they are learning and the rest of their experiences, thoughts, and feelings.

Keywords: e-learning, blogs, higher education

What do our students need?
What changes must be made in the educational system?
What do professor need to change to make students learn?
Are we ready to introduce in the learning process informal discussions, comments on Facebook, TED talks or blogs posts?
Can we change standardized exams with individualized assessments?

1 Briefly about Blogs

According to the definition provided by Oxford dictionary a blog *is a regularly updated website or web page, typically one run by an individual or small group, that is written in an informal or conversational style* [1].

Until 2009 blogs were usually the work of a single individual occasionally of a small group, and often covered a single subject.The emergence and growth of blogs in the late 1990s coincided with the advent of web publishing tools that facilitated the posting of content by non-technical users [2].

In the educational area, the educational blog can be a powerful tool that can provide different opportunities of using creatively the internet both for students and for teachers.

An *edublog* is a blog created for educational purposes. Edublogs archive and support student and teacher learning by facilitating reflection, questioning by self and others, collaboration and by providing contexts for engaging in higher-order thinking [3].

According to Matt Lingard there are multiple uses for blogs in Higher Education:

1) Commentary & Expert Analysis. Blogs are an ideal tool for disseminating regular commentary and opinion. These blogs might be written by a single author or several. Multi-author blogs in particular can provide an opportunity for Improving professional communication and expanding impact.

2) News & Announcements. This covers a variety of uses: departmental news, service updates, events or the latest information on a specific theme

3) Supporting Research Projects. A website is a common requirement for funded research projects. Blogs make an ideal tool for recording the process and disseminating outputs.

4) Learning Journals. Students can use blogs to support & develop their learning. These blogs are often reflective and might be private, shared with a teacher or completely public.

5) Learning Communities. This could be a group blog for a course involving teachers and / or students using it to share information and discuss the course. Learning communities can also be more loosely connected networks involving many individuals reading and commenting on each other's blogs around a common theme.

6) Personal Homepage. Blogs can be used by university staff and students as an alternative to a traditional homepage.

7) Resource Sharing. Many blogs are developed specifically to share resources with their community

8) Collaborative Authoring. Blogs can be used to develop a 'publication'. The commenting functionality allows readers & collaborators to comment on each other's text [4].

Morrison outlines his visualisation of the future of e-learning as encompassing simulation ('an environment where learners can practice, fail, succeed and learn in a rich and realistic setting; mobilisation (by which he means the use of PDAs and WAP-enabled devices); and permeation (in which learning simultaneously delivers many types and forms of learning at different levels of granularity)[5].

2 In practice

The second part of this paper is aiming to present how does CREDIS team use blogs, in practice. We wanted to explore the pros and cons of using blogs to support self-expression, self-reflection, social interaction, and reflective dialogue among students.

The target group was represented by students of University of Bucharest, Faculty of Psychology and Educational Sciences, enrolled in the second year at Pedagogy of Pre - School and Primary Education - bachelor programme.

The presented study took place during the second semester of the academic year 2014-2015. The study was conducted by professor Bogdan Logofatu during the course Computer Based Learning. All students were familiar with e-learning tools (from the previous course from the first year - *Information and communication technologies*).

The main purpose in using blogs as an e-learning tools for evaluation was to encourage students to learn by writing, to reflect, evaluate and internalize the information provided through the curricula. It is also very important for students to learn how to use the web as an important tool in extending their knowledge and make connection between what they are learning and the rest of their experiences, thoughts, and feelings.

2.1 Choosing a platform

The first challenge was to choose the right platform. After analyzing the internet and looking for best practice examples and results in implementing blogs in the classroom we had to choose between Wordpress and Google Blogger.

When we had to choose the right platform we took into the consideration the following criteria:

- Free of cost
- A well-defined structure;
- An intuitive organization;

- A user-friendly interface;
- Support during use.
- Security for student information and security of intellectual property

The decision was for Google Blogger - one of the products of Google Company. We have to mention that CREDIS Department has subscribes to Google apps for education (all apps under one free, unlimited account.). Another argument in favor of Blogger was that in November 2014 CREDIS has started to implement the Google Classroom platform for the students enrolled with the academic classes delivered by professor Bogdan Logofatu: more than 350 students and seven classes; the study programs were at the level of Bachelor Degree (one program with 185 students) and Masteral Degree (four programs with 165 students).We use Google Classroom to communicate important information such as homework, important dates, missed lessons, etc.

2.2. About Google Blogger

Blogger is a tool that makes it easy to instantly publish weblogs or "blogs." Blogs are simple web pages, often made up of short, informal, and frequently updated posts. Blogger makes it easy to create blogs, post text and pictures, and start generating feedback in minutes [6].

To start a blog with Blogger first you have to visit the Blogger homepage - https://www.blogger.com/-, enter your username and password, and click Sign in. Enter a display name and accept Blogger's Terms of Service. Then click the Create a Blog link and get started! Pick an address (URL) and a blog title. Then, choose your favorite blog template (this is how your blog will look when you publish it). After you set up you blog it encourage you to be creative, to add information to your personal profile, and customize how your blog looks [7].

In practice, after choosing Google Platform and having students set up their accounts, we considered useful to create video tutorial that served as models and guides for students. All this video-tutorialswere delivered to students at the beginning of the class. The second step was to provide them a list with recommended websites with additional information. Even if we published these learning materials, it is very important to mention that during the class we teach students how to set up their site and guide them through the process.

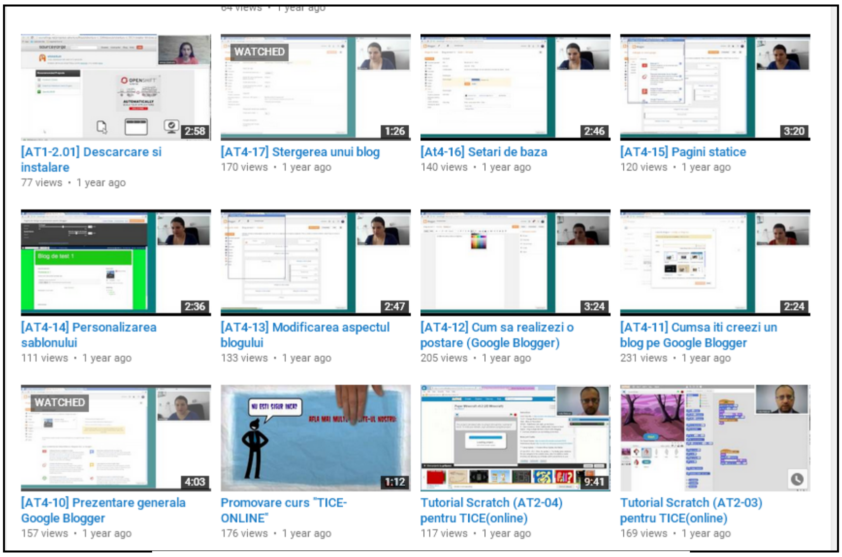

Fig. 1. **Screenshot video-tutorials for Google Blogger**

Another question that it may appear is *why an individual student blog?* And not a class blog. Well, by looking at the XXI st century competences we wanted for our students to be involved in self-directed learning process, to be active contributors, to be concerned citizen and confident persons. Having all this as a goal we believe that a student blog can help students develop ownership; provide a workspace for assignments, brainstorming, process-oriented activities and questions of design.

2.3 Assessment task

The assignment represented 20% of the unit's total assessment and was consisting of two parts: a written component - a series of blog entries-and a SWOT analyze on a digital manual (recently implemented in schools by Ministry of Education). The blog entries were each to be reflections.The main interest of this blog entries were to make students read, to think about what they were reading and to make connection. After that you start to make your own ideas and write them down.

The best thing about this entire process is that in every stage you learn!

2.4 Evaluation criteria for Blog:

1. Blog graphics (general look, template selected, gadgets included, color palette applied, etc.)
2. The relevance of topics in relation to the theme of the blog
3. Blog style: a blend of informal and non-formal
4. Correspondence between the blog title and URL of the blog
5. The existence of two categories:
    a. Reviews classes (Journal reflexive) - mandatory;
    b. Posts on new technologies in education.

Title posts should be attractive and not too long,

Blog posts must have:

- ✓ continuity;
- ✓ relevance (to reflect the authentic learning experience)
- ✓ respect copyright policy (mentioning sources for both text and images, videos, links);
- ✓ diversity in terms of sources used (a post should contain information taken from at least 2 sources);
- ✓ at least a paragraph of review vis a vis the author of the blog topic.

2.5 Monitoring the process

After 3 weeks a form was open for student to declare their blog address. Through this form theblog accounts of the students were made available to the professor that was able to assist and to monitor the process. The professor, therefore, was able to provide feedback as well as monitoring the new entries posted by the students.

With two weekends before the end of the semester, during the labs, a final preview of the blogs was made. Every student presented their blog to the professors and to the other colleagues and final remarks were made.

When we started this different approach for assessment we wanted to provide students the opportunities to promote their skill acquisition. Blogging with a purpose and providing new form of feedback were our main goals.

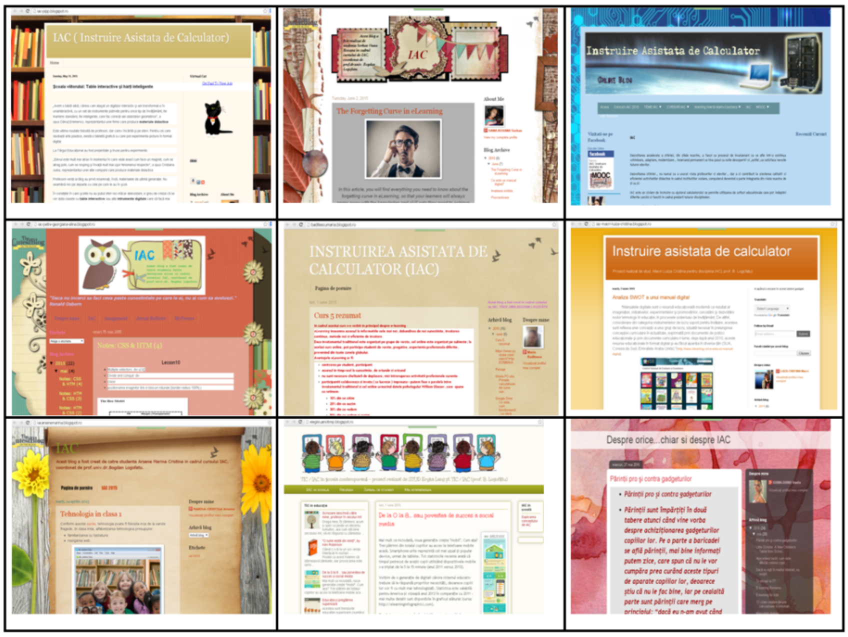

Fig. 2. **Screenshot students blogs**

At the end of the process it was important for us to find out students point of view regarding this initiative. A survey was conducted and one of the questions was: *On a scale from 1 to 10, what grade would you gine to the initiative to build and develop a blog as an assignment task for a course?* The responses conducted that 35.7% of the students graded 8 point to this initiaive, 8 student - 9 and 9 students 10 point (as presented in the figure below). The results are encouraging but there are also students who didn't get the purpose behind developing a blog. Many of them think that they already have these digital skills and do not see the reason for learning and developing a blog.

Maybe one of the reason for which some of the students didn't pay too much attention or interest to the task was that the percentage obtained at the end was too low to justify a high level of commitment.

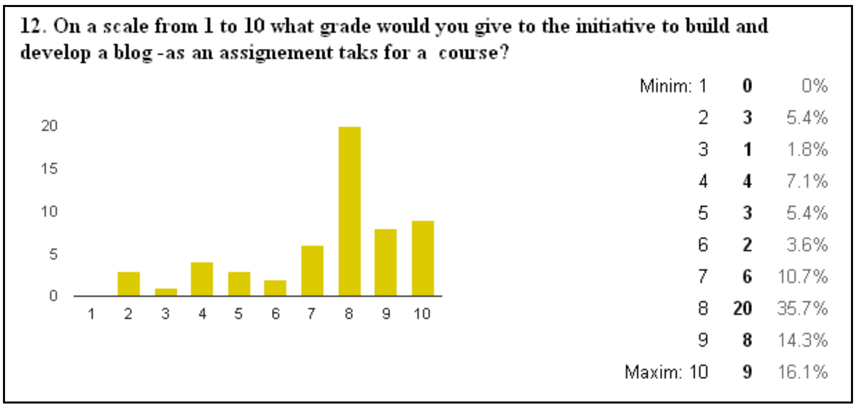

Fig. 3. **Grades provided by students to the initiative to build and develop a blog as an assignment task for a course**

Furthermore, we were interested in the attitude developed by students to blog and if they intend to develop their blog even when the course is over. Through blogs students can generate discussion for the next year. A project started in one class doesn't have to end once the class in over. \the blog offers them the opportunity to respond to each other's comments, to change ideas and they can even build their own online community. In our study the students were were divided in two big categories, one who intend to continue blogging and one who haven't yet made a decision on it.The results are presented in the figure below.

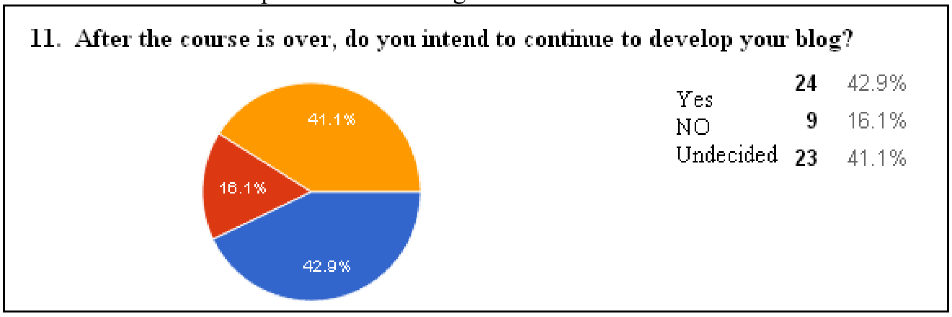

Fig. 4. **Students intention for blog development after the course is over**

Conclusions and future directions

The outputs of this study have implications both for students and professors, especially now when they are encountering the challenges of a mix of learning methods and resources.

The case study presented in this article is just an example, a pilot test and we believe it can be used for others to learn from it to develop e-learning activities and to integrate e-learning tools into an assignment task. Particularlyblog as an assessment tool is a different approach to learning process improvement.

Through blogs students can improve writing skills, motivation, and engagement in the community, critical thinking, creativity, control and ownership.

As a recommendation – a blog can represent one of the methods through which professors introduce informal discussion and comments in the learning process and also a possibility for changing standardized exams with individualized assessments.

All we need is an open mind!

Acknowledgements

The authors would like to express their special acknowledgements for valuable discussion and support to professorBogdan LOGOFATU, an example of a mind open professor always looking to uncover and testing the latest e-learning solutions.

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Customizing Medical English learning with Edmodo

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Abstract

More and more real world tasks are multimodal, collaborative and international. Using technology means sharing and transcending borders, which is crucial in the medical field research, disease and patient management. Medical students need to form the skill of using technology such as virtual environments and platforms for real-time and asynchronous communication with peers via English, in a complex, precise, highly technical, unambiguous language, where any misuse or ambiguity is likely to endanger human lives. This paper will reflect on using Edmodo in teaching/learning Medical English, more specifically on challenges referring to material development and customization in a branch of ESP (English for Specific Purposes) where technology-based models are meager. We will demonstrate that Edmodo facilitates integration of skills, learning-oriented assignment, individualized written and audio feed-back, fluid revision and improvement, multimedia embedding, permanent back-stage communication with the students, evidence of student progress as well as the possibility of knowing the students' needs and responding to these needs in almost real time. Despite certain challenges, our exploitation of Edmodo in Medical English learning demonstrates that new technologies can be a catalyst of learning by fostering motivating, authentic activities that will help to bridge the gap between class Medical English learning and demands of the real medical world.

Keywords: Edmodo, Padlet, English for Medical Purposes, communicative competence, emerging technologies

1 Medical Jargon

The fact that communication errors and potential misunderstandings are likely to jeopardize lives makes communicative competence (Achmatovna, 2014; Van Naerssen, 1978) a crucial aspect of the medical field. Doctors communicate with their peers and nurses and other care providers on daily basis using a specific jargon that includes euphemisms, acronyms, abbreviations, eponyms.

The extent to which medical English is a highly technical, complex language can be better ascertained if we consider its limited comprehension by lay people in their own mother tongue, patients often struggling to understand their condition, treatment and test results. Future professionals need therefore, to be fluent not only in the highly technical medical vocabulary and jargon when communicating with peers and doing research but also in appropriate and effective familiar language when addressing their patients.

Formation of this double-faced communicative competence in pre-service medical students is a long-range desideratum, which presupposes investment of time, engagement and autonomous practice beyond the limited English for Medical Purposes (EMP) higher education syllabus.

This paper entertains the idea that medical students can and should benefit from extension and customization of EMP learning through technology-based practice in order to improve their EMP communicative competence and be better fit for the real challenges of the medical field.

2 Blending Edmodo to reach and teach every student

For the EMP teacher, exploitation of technology becomes an alternative to reach and teach every student in contexts of large mixed ability groups. Through exploration of virtual learning platforms every student is offered a chance to contribute and receive teacher- and peer-feedback, irrespective of their language proficiency, verbal or non-verbal learning style, and personality type, i.e. outspoken or shy student.

Starting from this premise, *Edmod*o was used in a blended learning approach (Vander Ark, 2012) to EMP for first year students of the University of Medicine and Pharmacy of Tirgu Mures, Romania during the academic year 2014-2015, i.e. classroom activities (Fig.1) were complemented or supplemented by activities delivered via digital platforms or mobile learning (Fig.2), mostly outside the classroom (Dale, 2014).

Fig. 1 **In-class speaking**

Fig. 2 **Mobile learning activity**

Edmodo is a collaborative platform very similar to Facebook, specifically geared towards use in teaching and learning. It is "a free and safe way for students and teachers to connect and collaborate" (Pinard, 2014). Among the variety of features that make Edmodo an ideal, secure, user-friendly platform for language teachers are:

- polls, quizzes, progress monitoring and Snapshot to check the students' progress;
- sending assignments with specific deadline and locking the turning-in feature after the deadline;
- e-mail notices – whenever a student replies, new materials are uploaded, and the group has a new member;
- possibility to send personal messages and make posts public;
- locking and unlocking the group for safety reasons;
- sharing: resources, links to interactive vocabulary practice (Fig.3) and folders;
- managing group members;
- sharing of resources and connecting for content with international educators (review, curate, sell and purchase original materials) through *Edmodo Spotlight* (in Beta) (Mittal, 2015).

3 Pioneering Edmodo in English for Medical Purposes

With few exceptions (Allum, 2014) application of emerging technologies (wikipedias, blogs, synchronous and asynchronous speaking and writing tools) in teaching EMP has been hardly documented both in terms of best practices and outcomes.

Specifically, Edmodo (E) has grown popularity especially in American education where the platform serves as an ideal link between teachers, students and parents. Still, there is only one group of Edmodo teachers in Higher Education (including 35 members to date), which classifies our Edmodo EMP piloting (E-EMP) into the categories of pioneering endeavours.

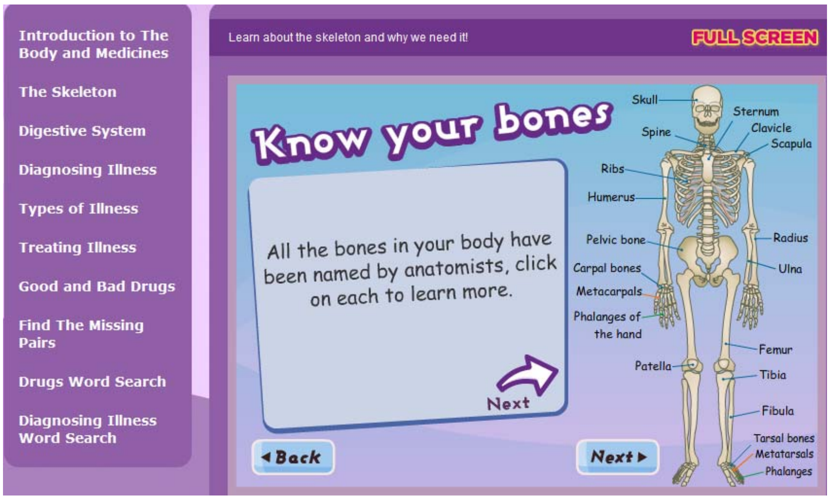

Fig. 3 **Links to interactive vocabulary in the E-Library**

The starting premise for E-EMP was that student engagement and further practice enhances EMP learning outcomes. Second and no less important was the need for communicating with students on a regular basis: if students use social media (Facebook) to communicate informally, turning the Edmodo social media potential to professional use to connect and communicate, let alone in English, is legitimate.

Edmodo Medical English group was created to supplement classroom learning and EMP communication and 119 students engaged in regular, self-paced activities. There was a set number of assignments per semester whose successful completion contributed 33.3% to the final grade (i.e. final evaluation included: mid-term written test, Edmodo projects and oral answer).

3.1 Task customization and skills

Although theoretically any class activity can be transposed to Edmodo, lack of models and customization for medical English remains the major challenge to be faced. We attempted to address all basic productive (speaking and writing) and receptive skills (listening and reading) as well as specific EMP sub-skills: development of survey-based research project, identifying barriers in doctor-patient communication, arguing, thinking critically, debating on ethical issues, writing a research paragraph.

Edmodo-supported (E-supported) task-based and pedagogic communicative activities were customized as follows:

1. **E-Writing** on *Local health aspects* – This was a meaning-focused, i.e task-based learning activity that aimed at fulfilling the communicative writing task of writing research papers involving real world processes of language use. Each student had to write an article based on a 15-item questionnaire on local health problems, previously administered to patients. Sub-skills included: collecting answers, interpreting results, reporting results, writing a research article. The project represented the students' first interaction with patients, whether these prospective patients were their sick relatives, neighbours, or other patients, shaping also the development of their soft skills: communication and professional attitude in conducting medical research.
2. **E-Listening and speaking** – *Clown care – The Children's ward* – was based on Movie segments (Azevedo, 2013) and reading https://en.wikipedia.org/wiki/Clown_Care . Besides information inference and vocabulary consolidation, students spoke about

humour-based complementary therapies in terminally-ill pediatric patients. Answers were recorded on mobile phones or on computers (using voice or video) and uploaded on Edmodo.

3. **E-Listening and writing** with *TedTalks.* After listening to medical talks (e.g. a surgeon speaking on the essence of his medical career), students had to write a 200-250 word **essay** by answering several questions that checked their exact understanding of the topic and include their own opinions.
4. **E-Writing** via **Padlet wall** writing tool - *Introductory discussion* on the doctor's qualities exploited reflective paragraph writing (http://padlet.com/chirurgiecardio/9k1yma 6qbw4w).
5. **Other E-supported activities** such as further debates on topics dealt with in class:

a. **Ethical debate**: "Reporting or not reporting mental illnesses", the case of airline pilots' mental conditions and the stigma they trigger generated long argumentative contributions, the debate coinciding with the tragic events of the Germanwings aircraft crash in the French Alps. Students brought impressive contributions demonstrating critical thinking , which are meant to form their ethical attitudes, e.g. by student Sorana M.:

"*Most people who experience mental health problems recover fully, or are able to live with and manage them, especially if they get help early. But even though so many people are affected, there is a strong social stigma attached to mental ill health, and people with mental health problems can experience discrimination in all aspects of their lives. In my opinion reporting or not reporting this kind of cases, especially when it comes to pilots is a question of privacy, confidentiality and ethics. A number of factors such as a history of depression, substance abuse, or suicidal thoughts should be assessed before disclosing personal information. But according to Dr. Diane Damos, who holds a doctorate in aviation psychology, serious psychological testing is impractical due to the high number of pilots and the subjectivity of the test. In short, pilots must self-report mental health issues, — issues that could mean losing their flight certification - they answer some questions and the doctor should form a general impression about the emotional stability and mental state of the applicant…… (excerpt)*

b. **E-video and debates** on the complex world of mental conditions: 1. Autism: *Temple Grandin* and 2. Schizophrenia: Elyn Saks in *A Tale of Mental Illness from the Inside* on Tedtalks; 3. *Dr. House* - reflecting on doctor-patient communication barriers.

c. **E-games** for language acquisition and consolidation (Fig.4)

d. **E-backchannel** for knowing the students' needs and responding to these needs in almost real time.

Fig. 5 **Surgery game**

3.2 Benefits of using Edmodo in EMP

The benefits of our exploitation of complementary optional EMP practice and engagement on Edmodo were:

- **Additional asynchronous practice and communication**: Edmodo significantly extended the EMP communication in medical jargon and lay terms in a motivating and stimulating way. Basic language and communication skills, sub-skills (critical thinking, essay and article writing, writing and expressing ideas clearly and concisely, presenting them effectively, analyzing and criticizing them, surveying, collecting answers, interpreting and reporting results, identifying barriers of effective doctor-patient communication), and soft skills (professional interpersonal and social communication, ethical attitudes) were addressed.
- **Student-centered approach**: Each student's needs were addressed and feedback offered on an individual basis. Students were offered either audio or written feedback, the former creating a feeling of immediacy and direct communication, which is vital in any virtual and asynchronous learning experience.
- **Fluid revision**: Multiple revisions were possible and recorded for teacher observation whereas assignments were student-centered and learning-oriented in that the students responded to the teacher's continuous monitoring by re-editing and amending their productions until satisfied. Likewise, the teacher could adapt the assignment according to student feedback, which is unlikely to happen in paper-and-pencil tasks where realization of shortcomings and error correction comes usually too late to be capitalized on in real time by the student.
- **Collaboration from a distance**: students collaborated from a distance, which is an essential learning objective for the future doctors.
- **Learner and learning-oriented communication**: lower proficiency students were allowed sufficient time to prepare before submitting (generous deadlines and multiple available resources).

3.3 Edmodo limitations

Some missing features we would have appreciated and could have improved the platform communication are:

- direct streaming (audio file embedding) is not allowed, only downloading.
- links or attachments are possible only in initial posts but not in replies.
- there is no chat feature (real time communication) which was present in earlier versions of Edmodo.

Conclusion

Technology brings novel opportunities but also challenges in language education areas such as EMP, where models are missing. This piloting use of Edmodo in Medical English learning demonstrates that emerging technologies can be harnessed to make students more active, interactive and involved communicators in E-activities that are multimodal, collaborative, student-centred and autonomy-stimulating.

Tasks can be designed to reach and assist every student and customized to address general and specific medical English communication skills, sub- and soft skills. Until further studies assess the students' level of satisfaction with their E-based learning, we entertain that Edmodo can be a catalyst of learning by fostering motivating activities likely to make students more fluent in communicative competence and digital technology while bridging the gap between class Medical English learning and demands of the real medical world.

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A Study on the Linguistic Elements of Vagueness in the Didactic Discourse

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Abstract

The interest of our research lies in the linguistic dysfunctions of communication, more precisely on the presence of the elements of vagueness in the didactic discourse. The message as the central element of the educational communication is one of the sources for the emergence of dysfunctions. In terms of content, the message can be simple, intelligible, accessible or, on the contrary, it can be hermetic, academic and ambiguous, which implies an effort of understanding and interpretation. As vocabulary knowledge enriches, the sources of linguistic ambiguity grow, triggering dysfunctions which impede the didactic communicational process. Vagueness in communication refers to the frequent use of some words from everyday language whose denotations are not clearly defined in various situations of verbal interaction. Consequently, we have identified a series of elements of linguistic vagueness based on specialised literature. The study provides descriptive analyses for each item aiming to determine their impact on the proper understanding of the didactic discourse by means of a hierarchy of the identified elements at high school and university levels. The results of the research can be of interest for teachers in the aimed school levels in order to make the correct decisions to optimize the process of didactic communication.

Keywords: Didactic discourse, Linguistic elements of vagueness, Linguistic dysfunctions

1. Introduction

From a linguistic point of view, in broad terms, vagueness in communication refers to the frequent utilization of some words or phrases whose denotations are not well defined in precise situations of communication (Agabrian, 2008; Dinu, 2004; Dortier, 2010). Specialized literature considers linguistic vagueness as one of the dysfunctions in communication (Dortier, 2010; Pânişoară, 2004; Sălăvăstru, 2004) as its presence in the communicational act prevents the transmission of clear, explicit messages.

Our research narrows its focus on the linguistic elements of vagueness in the didactic discourse. It is common knowledge that clear and precise communication boosts the process of learning. Research has shown that there is a negative correlation between the frequent use of vague terms and the performance in learning. Thus, students exposed to a clear discourse learnt more than those who were delivered a vague discourse. In this context it can be appreciated that vagueness in communication annuls the intrinsic relationship between linguistic competence and cognitive competence on the part of the student (Dumitriu, 1998; Sălăvăstru, 2004).

Vagueness in linguistics is connected to a variety of categories such as gradability, modifiers, modality, intensifiers of negation, indefiniteness, anaphora, polysemy, figures of speech etc. Gradability refers to the possibility to use submodifiers to express the degree to which a predicate, typically an adjective, holds. In grammatical terms, a modifier is defined as a word that describes another word or group of words. Structurally, there is usually one main word (head) in the phrase to which can be added one or more modifiers to specify its meaning more exactly. Multiple modifications can be met in several cases: when more than one modifier applies to a single head, one modifier applies to more than one head, a modifier applies to an already modified head. As a rule, in the act of communication the improper selection and use of modifier(s) may generate ambiguity in understanding the message.

Polysemy refers to the ambiguity of an individual word or phrase that can be used to express two or more different meanings. Linguists agree that there is a correlation between the development of a culture and the growth of polysemy of words. Thus, as already existing words enrich with new meanings, the sources of linguistic ambiguity grow, triggering dysfunctions which impede the communicational process.

Modality embraces a range of semantic notions that allow us to talk about states of affairs which are not present in the current situation and may never occur in the actual world. Modal expressions involve some kind of non-factuality: a situation is represented not as a straightforward fact, as not being known. A fundamental aspect in dealing with modality is the difference between the deontic modality (ranging from permission to strong obligation, with weak obligation as an intermediate value) and the epistemic modality (from possibility to certainty, with probability as an intermediate value). As modality expresses personal judgements on the extra-linguistic reality, the message can be interpreted in multiple variants by the interlocutor(s), situation which may lead to gaps in the communicational act.

Broadly speaking, indefiniteness refers to lack of certainty, precision in meaning. Intensifiers of negation are negative adjuncts which scale down the meanings of the words they modify. If the discourse abounds in intensifiers of negation or indefinite determiners, be they pronouns, adjectives or adverbs, then the message becomes fuzzy, difficult to grasp.

Anaphora is defined as the use of a grammatical substitute (pronoun or a pro-verb) to refer to the denotation of a preceding word or phrase. Linguistic reference is a type of cohesive relation in the discourse. Anaphoric reference is a form of presupposition, pointing back to some previous item (the presupposed item). The presupposed item may be present in the same sentence, in the sentence immediately preceding or it may also be in some earlier sentence. Its use can lead to ambiguity in the act of communication if the message is too long, exhaustive.

Figurative language consists of forms of speech in which words are not used with their literal meaning. They are often used in the communicational act because they best convey what people attempt to say. However, their exaggerate use may result in flaws in the verbal interaction.

2. Presentation of research

The objectives of our study are: a) to identify a series of elements of linguistic vagueness by synthetizing information from specialised literature; b) to realize descriptive analyses of the linguistic elements of vagueness in the didactic discourse in order to establish a hierarchy for two school levels: high school and university.

The study included 100 participants, 50 high school students and 50 university students from Vrancea County, Romania. The age of the two groups of participants ranged from 15 to 23. The selection was based on willingness to take part in the study.

We have used a questionnaire which provided the opinions of the participants. It was conceived based on information gathered from specialised literature and from discussions in focus groups with students in the two school levels. The data collected led to the identification of a series of elements of linguistic vagueness in the didactic discourse transposed into the following items:

- gradability
- modifiers
- modality
- intensifiers of negation

- indefiniteness
- anaphora
- polysemy
- figures of speech.

The questionnaire's applying was preceded by a short training in which the respondents were explained with examples what each item means. The examples were provided by the researchers and the students themselves, thus demonstrating a correct understanding of the linguistic aspects under the lens.

The respondents were asked to choose one of the following variants of a five-step scale: (1) to a very low extent, (2) to a low extent, (3) to an average extent, (4) to a large extent, (5) to a very large extent, thus showing how often they came across the situations described by the items. The procedure allowed the collection of data emphasizing the relevance of some linguistic elements of vagueness in the didactic discourse.

Table 1. **Means and Standard Deviation of Linguistic Elements of Vagueness**

Items of Linguistic Vagueness	High school Mean (std. dev.)	University Mean (std. dev.)
Gradability	3.26 (1.322)	3.76 (0.824)
Modifiers	3.68 (1.253)	3.16 (1.037)
Modality	4.18 (0.661)	4.16 (0.817)
Intensifiers of negation	4.04 (0.925)	4.02 (0.820)
Indefiniteness	3.82 (1.137)	4.24 (0.960)
Anaphora	3.74 (1.178)	3.92 (0.877)
Polysemy	3.90 (0.953)	3.42 (0.536)
Figures of speech	2.98 (0.724)	2.90 (0.890)

According to table 1 the highest mean at high school was for modality (m=4.18), whereas for university level the highest mean was for indefiniteness (m=4.24). In other words these are the most important aspects which affect the most the adequate understanding of the didactic discourse. The lowest means were registered in both groups of students for figures of speech, m=2.98 for high school and m=2.90 for university. This means these are the aspects which affect the least the correct understanding of the didactic discourse, in our respondents' opinions. With the other items the hierarchic order varies as shown in table 2.

Taking into consideration the means obtained for each item we realized a hierarchy of the dysfunctions related to linguistic vagueness in the didactic discourse. Thus, the linguistic elements of vagueness in the 1st rank are considered to have the greatest impact on the appropriate reception of the didactic discourse, whereas the 8th rank means the linguistic elements of vagueness are perceived as dysfunctions in the didactic discourse to a very low extent.

Table 2. **Descriptive of Hierarchy of the Linguistic Elements of Vagueness for the Two School Levels**

Rank	High school	University
1.	Modality	Indefiniteness
2.	Intensifiers of negation	Modality
3.	Polysemy	Intensifiers of negation
4.	Indefiniteness	Anaphora
5.	Anaphora	Gradability
6.	Modifiers	Polysemy
7.	Gradability	Modifiers
8.	Figures of speech	Figures of speech

In order to determine the differences regarding the linguistic elements which define vagueness in the didactic discourse we applied the t-test and Levene test for the independent groups, in our case high school students and university students. We set the significance level to 0.05. We can state the relevance of the factors which determine linguistic vagueness as dysfunctions in the didactic discourse at each school level based on the significant difference from a statistical point of view between the appreciations of the two groups of students.

Analysing the appreciations of the two groups of respondents we identified significant differences for four items: indefiniteness, polysemy, modifiers, gradability. Two of the items register high means in the high school students' opinions (polysemy, modifiers) and two means are high in university students' appreciations (indefiniteness, gradability). The high means indicate that they have a greater relevance as dysfunctions in the didactic discourse from a linguistic perspective.

The inexistence of statistically significant differences in scores for four items demonstrates convergence of appreciations between the investigated groups. The items that did not register significant differences are: intensifiers of negation, modality, anaphora, figures of speech. In the case of the figures of speech the difference between the means is low (m= 0.08) and in both cases this item is considered the factor with the lowest influence as a linguistic element generating vagueness.

3. Conclusions

Our research led to the identification of a series of linguistic elements identified based on specialized literature and focus groups discussions as causes of linguistic vagueness in the didactic discourse. Mention must be made that the discussions in focus groups were extremely efficient as the respondents, the two categories of students, came up with a wider range of examples for each item investigated than those provided by the specialized literature. This demonstrates that the students are aware of the dysfunctions in the didactic discourse and are interested in preventing them.

Thus, the study of the linguistic dysfunctions in communication is justified by the need to identify the problematic aspects in order to either prevent or remedy them in due time in order to support the formation and the development of the communicative competence. In our case this seems imperative as the respondents in our research are students in initial teacher education programmes from a teachers' training department and from a pedagogical high school. At a larger scale, the results of such study might be useful for the researchers in the field of education who aim to provide teachers with pertinent information about the aspects needing remedial work in order to increase the efficiency of the didactic discourse. Further studies should be applied on greater numbers of students coming from various school levels. Moreover, the opinions of the students should be compared with the teachers' opinions in their quality of initiators and directors of the didactic discourse.

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Using computers in teaching

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Abstract

The issue of curriculum design and implementation on educational policy level; it is a topical concern and can become an efficient support to curricular decentralization. This can be useful as a scientific foundation that includes operational guidance useful for teachers and educational managers. The article shows a part of a larger research on the use of computers in teaching, learning and assessment. From the analysis of results show that using computers in learning-teaching-assessment is done by various resources: educational platforms, educational software, tutorials, PowerPoint presentations (all participating schools), Youtube movies, AEL.

Keywords: curriculum design, educational resources, school environment, educational actors.

1 Introduction

The issue of curriculum design and implementation on to educational policy level is a topical interest and become an efficient support for curricular and institutional decentralization. This can be a scientific foundation that includes operational guidance useful for educational actors - teachers and managers.

Using the new technologies in education has become an imperative for their implementation in education: in the curriculum, training of educators, didactic practice.

This research is part of a larger research (Institute of Educational Sciences, Laboratory Curriculum 2014) - Methodological framework for design and implementation of the curriculum to the school level.

In this respect, curriculum laboratory researchers had collaborated with seven partner schools.

2 Informational environment of the school

2.2 Educational resources used by students

Resources used by the students were extracted by processing the responses to the question "Frequently used resources in learning are: written material - books, collections, encyclopedias, manuals; online resources, online learning platforms, educational software; teachers; parents; colleagues; forms of media".

After processing the data obtained from schools, it is noted that the written material, online resources and educational software are used by all the schools participating in research of 100%. The information and skills acquired with the help of teachers is particularly important, a fact punctuated by 2/3 of the participating schools. Not to be neglected are other forms of media, namely 50%, affecting formal education. It pointed out that parents are not recognized as active participants in the learning process, students or classmates. This could support the poor performance of students in national assessments. As long as parents are not active players in the educational process and the environment in which the individual develops - respective classmates are disinterested, lacking team spirit and interest for school and learning we can not expect positive results.

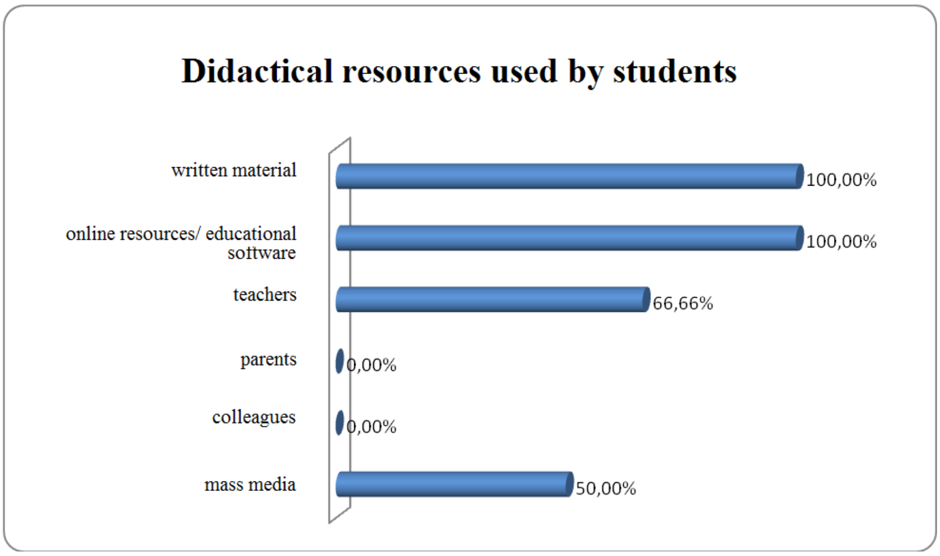

Figure 1. **Didactical resources used by students**

2.3 Using computers in teaching

Information about the use of computer in learning-teaching-assessment process had resulted from information provided by the responses to the question:"Valorising the teaching practices from your school experience, show 3 to 5 situations to using the computer in learning-teaching-assessment"

The analysis of results show that computer use in learning, teaching and assessment is done by various resources: educational platforms, educational software, tutorials, PowerPoint presentations (all participating schools), YouTube videos, AEL educational platform (mentioned by 6 of the participating schools).

Teachers recognize that the most attractive hours are the ones in which the computer is used as a didactic mean. The colourful images and movement activates visual memory, making the children more careful. At same time, the educational movies, the documentaries, the artistic videos, the theatre plays are watched with interest, thing which would be difficult to achieve without a computer and a video projector. Using the computer is not confined only to the classroom where the teacher presents specific topics. Children discusses on Facebook (in a closed group, which can includes the teacher) about topics, may request consultations in real time, seek and oneself inform about the sites indicated by the teacher. In his turn, the teacher can post teaching materials, books, references and bibliography and documentation information about specific issues.

The information revealed by the answers of the questionnaires emphasize that the computer is used on curricular subjects, like:

- Language and communication - to familiarize children with theatre, cinema, to make contact with various aspects of culture and civilization in different countries;
- Mathematics and Natural Sciences - for presentation of themes or for using educational software in teaching on discipline content (Romanian INTUITEXT platform currently offers 19 titles covering five subjects for primary, middle and high school: mathematics, physics, chemistry, biology and geography.);
- Man and society - for presentation of knowledge in history lessons or geography;

- Technologies - in secondary school, to the computer science hours, like ICT, but also in the optional hours (”My friend the computer”) students have used learning platforms online - Alice, ThinkQuest, AEL, Greenfoot. To the High school, the students have used various platforms like Oracle , ThinkQuest, ECDL, Cisco.

The resources used are varied, ranging from educational software, educational platforms, and on-line resources like YouTube videos or PowerPoint presentations made by the teacher.

It also mentioned the use of educational software in teaching on subjects content (eg INTUITEXT - software dedicated curricular area Mathematics and Natural Sciences is mentioned by two of the schools). INTUITEXT has both resources for teaching - learning and assessment.

All participant schools to research have used the computer in the classroom teaching. Also, the computer is used in the assessment process through the presentation of the projects and portfolios students, PowerPoint slides, and homework, exercises submission that students must solve on the spot, studies or additional sources of information through Internet access.

The link with parents are conducted via online catalog that provides information to parents about the regularity of weekly scores and frequency to courses of their child.

In the teaching process, the educational software supports the strengthening of knowledge and the online resources facilitate the accessibility to knowledge. In this perspective, the online platforms represent a different approach and enriched to the traditional education. During the hours of The school based curriculum, like 'My friend the computer ", students have used online platforms (Oracle, Alice, ThinkQuest, AEL, Greenfoot), educational software (Intuitext), tutorials - OS, Office 2013, HTML (http: //www.w3schools.com). At the high school grades are used platforms like Oracle, ThinkQuest, ECDL, Cisco.

The importance of new technologies for most of partner schools results from the the interest they have expressed by proposing the resources, such as:

- Digital textbooks for the primary classes and preparatory classes;
- Updating AEL - due to licence problems with Windwos 8, removing operating system has led to the loss AEL;
- websites with digital lessons;
- E-learning platform for schools;
- New textbooks accompanied by teacher guides and students;
- Educational software for all subjects;
- Development of educational on-line platforms coordinated by the Ministry of Education;
- Provision of textbooks / electronic auxiliaries accessible to all students;
- Providing the electronic guides for teachers;
- Providing the management materials adaptable to any schools.

3 Conclusions

Using the computer, tablet, interactive whiteboards, educational software can not replace the teacher-student dialogue efficiency, both in terms of knowledge transfer and affective and emotional.

Is recommended:

- corroboration of the written resource with digital resource;
- corroboration a laboratory experimental activities with thereof computer simulations;
- connecting classrooms to the Internet, the use of digital devices and digital content;
- mobilisation of educational actors and civil society to change the role of digital technologies in educational institutions.

In rural areas, most parents do not get involved in life of school, in learning, students do not have access to platforms, not have educational software, encyclopedias, handbooks. Online resources are using to solve the homework not for study. The problem books are used because they are required by teachers. Open educational resources are used to support education and can be accessed freely. At the moment the information is most dispersed on the Internet. As such, it is a pedagogical resource in itself and represents parts with which to build a innovative pedagogical process. By involving staff, the Internet and educational resources available to children can turn the classroom in a fun and interactive exploration process, a time of enjoyable learning.

Although the computer is used in most disciplines, this not always present during the lesson. Questionnaires processing of show that is a lack of modern didactic tools: magnetic boards, educational software etc. Also, few schools have system engineers to maintain computer network; usually this is done by the professor of computer science that is in this way overworked. In generally schools have one / two computer labs where are done specialty hours of - ICT or IT and teachers of other subjects have less access. Not all classes have video projector and /or computer; due to the accelerated development of IT, laptops and tablets on the market have micro-HDMI output or WIFI and the projectors present in schools do not have something and necessary couplings does not exist (the most school projectors have a VGA output that are incompatible). Generally teacher prepares lessons at home on your personal computer and when it comes to school, can be system incompatibilities. Some schools tried to equip the classrooms with modern equipment - computers and video, but found that, if the projector has no problems being mounted on the ceiling, the computer fails enough quickly and there is no one to ensure its maintenance. A solution would be changing manner of organization of the class so no the teacher will be come to class, but rather the students to come to classes that take place in the classroom intended of discipline or the teacher respective. In the opinion of teachers, ensuring of quality education in schools is done by harnessing new information and communication technologies as a means of teaching in training and in self-learning: radio and television programs, the Internet etc. The inconveniences due to the mismatch between technological support existent in schools and the needs of students and teachers is mitigated by collaborative activities online, thus reaching to a reverse learning in which the teacher post the learning materials / homework on the group, and into the classroom, teacher insists to the aspects which were not understood.

Internet use by students has yield and effective when used correctly and for educational purposes, making significant activities, bringing the values and healthy principles by providing information necessary to society, developing educational programs for others. It's hard to say which are the most used websites on the Internet are; according to the student's needs or preferences, they visit different sites. Certainly the most visited social network in the world is Facebook. When students need to solve the homework, they access Google or various educational sites.

Using the computer, tablet, interactive whiteboards, educational software, can't replace the teacher-student dialogue efficiency, both in terms of knowledge transfer and affective and emotional relationship.

For future research, it recommends the following activities:

- analyzing how is performed the experimental laboratory work and simulations on computer;
- examining how the classrooms are connected to the Internet and how are used the digital devices;
- identifying the mode how can be mobilized educational actors (school management, teachers, students, parents of students) and civil society to change the role of digital technologies in educational institutions;

- how the digital teaching resources are used and are reflected in the curriculum documents made at school level: calendar planning, units of learning projects;
- identification of activities that could provide support to the young teachers to use digital resources existing in school, to collaborate with parents (e-catalog), students, the local community and in enhancing the relationship between formal and non-formal education;
- identification of assessing learning through digital resources.

Use of a computer in the teaching process does not exclude the traditional means of education but together, in conjunction with other, reduces both the effort of student learning and effort of teacher for didactic process coordinating.

There are of course the disadvantages in that the student remain in a situation somewhat passive receiver of information simple and the abuse of images may prevent general intellectual development, I refer to abstract thinking and nuanced language of the pupil; he must learn to interpret the message sent to make these techniques a way of self-instruction.

To overcome these shortcomings teacher will ask questions that will point to certain moments to guide students' attention, to mobilize them so, the thinking and the information processing ability. Students are called to notify the elements of detail less observable to quickly preview of image, will initiate processes of analysis, synthesis, comparison, reasoning; the conversation is methodical process naturally associated in the conduct of such lessons.

Because the images are very suggestive, students may feel that they have understood the message presented when really it's just an apparent understanding, and the teacher is obliged to insist to overcome superficiality. Realism of the dynamic image, combining image with sound and motion, possibility create of physical reality through cinematic techniques especially lately by digital techniques, make the didactic film an extremely effective way to teach. This must be integrated into education as a means and not an end in itself; he will be design in a certain stage of the lesson, required by logic and strategy of lesson. The didactic film, PowerPoint slides should be preceded by discussions to prepare students for optimal reception of the message sent.

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"Hello, what is the exam date again?"

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Abstract

Due to the propagation of Facebook as an almost instant means of establishing new social connections and staying in touch, it seems only natural for communication between university students and teachers to adopt the many facilities offered by this ever-expanding, accessible social network. This communication on Facebook and its associated apps, however, has its inherent advantages and drawbacks. In this paper, I would like to analyze the pros and cons, and see what impact they have on the traditional relationship between students and teachers.

Keywords: student-teacher relationship, Facebook-mediated communication, accessibility, Facebook-Friend teacher

1. Introduction

Recent statistics (2015a) have revealed that Facebook dwarfs all other social networking sites when it comes to the number of active users, which has now reached 1.44 billion. Facebrands.ro (2015b) shows that 8 million of those global active users are from Romania. According to the same site, approximately 25% of those 8 million users range between the ages of 18 and 24 years old, the average age of university students. During a study carried out at the West University of Timisoara on their first-year student population, Grosseck et al. (2012) contend that students are native Facebook users. Most teachers that I know, many of whom are colleagues of mine, are also a dab hand at using this social network. So it seems only natural that when the two parties intersect, their virtual selves should follow suite. And when this happens, Facebook allows them to stay almost permanently connected.

Facebook's groups and messenger features have allowed it to become a favourite and easily accessible means of communication. This is also due, I believe, to the propagation of smartphones among most students and teachers. Facebook applications on these devices have made it easier to stay logged on constantly, seeming readily available at least in theory.

This paper analyses the availability of communication via Facebook by trying to pinpoint its advantages but also by trying to identify any potential drawbacks of this virtual relationship.

2. Advantages

Grosseck et al. (2012) offer a comprehensive list of the advantages that Facebook bestows on students and teachers. Facebook allows the former to foster positive relationships with peers, to participate actively, to develop a positive attitude towards learning, to develop interpersonal intelligence, to create their own learning path, to consolidate self-confidence and self-esteem, to communicate with the teacher outside classes. The latter, the teacher, profits from Facebook by enhancing the credibility of teachers engaged in contemporary student culture, by practicing differential pedagogy, by achieving a change in strategy and mentality, by accepting the student as an interaction partner, by performing mentoring, by interconnect learning experiences, etc.

Facebook is so complex because the advantages it offers are personal and professional, at the same time, both inextricably intertwined. It allows a users to belong to various social networks, and, most importantly, to create their own. Researchers united under Zizi Papacharissi's editorship in *A Networked Self* (2011) and D. E. Wittkower's *Facebook and Philosophy* (2010) have tried to explain the lure of the social network.

Paramount in understanding this attraction is the idea that the drive to establish a network exists from the start, as Barabasi (2011) explains in the "Introduction" to *A Networked Self.* There is no magic moment when the network appears; it simply evolves and expands, accumulating more and more connections, of both the professional and personal kind, in the case of university teachers. They exist in order to spread ideas, knowledge, influences (Barabasi, 2011).

As a parenthesis, networks consist of clusters of nodes and links. The nodes are the individual users whereas the links represent the relationships established between the nodes. The same Barabasi (2011) argues that networks are formed according to the power law distribution. There is no randomness, the longer users are part of a system, more relationships they establish and the more links a node has, the more links it is likely to attract (idem). A node needs to fulfill certain requirements in order to become highly connected, such as fitness and robustness (boyd, 2011).

Teachers are such nodes characterized by both fitness and robustness, as waves of new students seek them out and connect with them on Facebook. Since communication on Facebook and its tangential apps (Messenger or Groups) is made irresistibly easy, it is only natural to connect. Thus, teachers find themselves tied to what are in fact temporary relationships with students that are only part of one's life for three to five years at the most, if one is to take into account students that follow postgraduate studies.

From my own experience with students, communication with them takes place mostly in closed or secret groups, or in private, with the help of the Messenger. Discussions usually revolve around various administrative problems, exams, exam dates, materials, attendance, etc. Another possibility would be posting on one another's profile, or wall, but that is a very rare occurrence since once you do that everybody in the addressee's Friends' List can see what has been posted. Groups are thus an ideal way of focused communication because it connects a number of people, who share the same interests, in one single place making it infinitely easier to disseminate information.

Messaging, on the other hand, ensures privacy, since it is one-to-one communication. It is almost an instant, but also unobtrusive, means of talking to someone, giving the addressees the chance to discover the message in their own time, or ignore it if they are busy or they do not want to read it, which, in turn, sets the senders at ease that they are not intruding. Moreover, the Groups and the messenger allows senders to check if their message has been "seen" by the addressee, in the case of the messenger, or how many members of the group has seen the post, in the case of the groups. Also, the fact that many Facebookers own smartphones also plays a big role in ensuring the "instantness" of this communication. As Craig Condella (2010) contends, "Facebook has surpassed telephones, cell phones and email as a more natural way of communication."

The need for easy communication with one's students during the academic year means that at the end of the relationship, teachers are left with a large number of temporary Friends. This helps them in growing as nodes since networks expand cumulatively, the great number of links serving as guarantee. At the same time, however, it leaves them Friends with mostly virtual strangers.

Another great advantage, and attraction, offered by Facebook is exactly this Friends' list. danah boyd (2011) identifies four main features of life in a social network: uses' profiles, their Friends' list, public commenting tools and streambased updates. The special feature of the Friends' list, and the only one of the four I am going to insist on in this paper, is the fact that everybody on that list is equal. Their offline differences are rendered redundant in the virtual world. These Friends consist of more than just those people we might call "friends," they are family members, coworkers, bosses, passing acquaintances, students, teachers, and often even strangers. Tamara Wandel and Anthony Beavers (2010) argue that the Friends' umbrella can actually include some enemies.

The reason this list is important is due to the fact that it represents an audience for which each user performs. This audience, however, is not homogeneous consisting of several publics (boyd, 2011) which sometimes overlap. This may very well be the reason so few students and teachers choose to post on one another's walls: the message is available to all publics, most of which are not interested in finding out about exam grades, or class postponement. Nevertheless, it is for this invisible audience, this imagined public, that Facebook users acts when posting.

The power of this public is tremendous stemming from one of the four important affordances of social networks, namely scalability (boyd, 2011). Internet tools allow for the distribution of materials but what is actually propagated depends largely on what the public finds interesting and likeable. Ideally this makes Facebook an important political and educational tool, helping disseminate knowledge, ideas, projects, information. In reality, through its "Like" button Facebook has given birth to the couch activist. It has become a power onto itself, working to boost self-esteem rather than spread information. It begs the question how many teachers opened their social networks to their students in search of this superficial appreciation and apparent popularity.

Another advantage of Facebook is that the affordance of scalability makes it a powerful marketing tool, for instance when it comes to student recruitment. This might be another reason why teachers open up their networks to include students. The spread of Internet technology in people's every day life, together with a plethora of choices available to future students has left schools, universities and teachers scrambling to attract customers. Since each student represents a node, involved in its own network, any new student might act as advocate carrying word and information about a certain university, faculty to its own links.

3. Disadvantages

Besides its countless advantages, a relationship between teachers and their students on Facebook is also fraught with dangers if one is not careful in managing the connection.

A first important drawback of Facebook is exactly the Friends' list. As mentioned above, the term of Friends is an equalizer, negating many barriers and distances that one might come across in the offline world. Although, Friends and friends are only partially synonymous, the term implies closeness, intimacy, approachability. It means simultaneously less than what it actually means and more. "Friends" means more than its definition because, on Facebook, it encompasses more categories of people, not just one's close real-life friends; it means less because the social ties to colleagues, bosses, students and teachers are weak. This has prompted Kate Dailey, author and blogger, to claim that Facebook does not make users better friends, instead we are becoming better acquaintances (Hamington, 2010).

By being part of the teachers' "Friends," and vice versa, students become witnesses to what the teachers' post, be it pictures, likes, dislikes, private family moments, rants, holidays, etc. They get to know the teachers in more than their professional roles. This closeness, although understandable, might lead to misunderstood availability, in return for "being cool." Going back to boyd (2011), she claims Facebook collapses contexts making power distribute more or less uniformly across the board. Add to this what we could call online disinhibition, and we could have a recipe for important changes in the offing.

John Suler (2004) speaks of "the online disinhibition effect" making Internet users bolder than they might be in reality. It stems, he argues, from various causes, such as Internet communication being anonymous, and asynchronous, the parties involved in the communication being invisible which minimizes authority. Facebook, however, negates most of these causes: the users are hardly invisible and anonymous whilst, with the help of the Messenger, communication is quite synchronous. This does not deter students from becoming familiar with the teacher, from perceiving this connection, as availability. Online disinhibition also affects the teachers, especially when it comes to what they post, what they comment on other users' posts, or even their students'.

This disinhibition leads to another problematic issue of Facebook-mediated teacher-student communication, something I have named "student-insertion in the teacher's out-of-classroom life" (Pele, 2015). This translates into students approaching the teacher for the most banal of questions such as the one I have used for the title of my paper. The engagement with students through Facebook eliminates the need for any middleperson, such as the Faculty secretary, when the students think they are facing a crisis related to their academic or personal life. Especially in the weeks preceding the exam session, I personally became flooded with messages from my students about the materials they were missing, the date of the exams, the rooms, rescheduling for various reasons, etc. The scenario repeated itself without fail before the re-examination session, although all dates and rooms were communicated by the Faculty secretary. Due to the accessibility of the Facebook Messenger application and the perceived approachability of the Facebook-Friend teacher, the students understandably preferred to go directly to the source, regardless of whether I was available to answer their queries or not.

Another consequence of this disinhibition effect is the increased informality between students and teachers, which again is quite understandable in the "Friendly" environment of Facebook. The longer you are part of the network, the system, the harder it is to remain formal. Nevertheless, as inhibitions are shed in this virtual world, as barriers are lifted (Meyrowitz, 1986), I argue that the teachers actually lose some of their traditional status amongst their students. Since, as Facebook users, everybody is equal, the teacher becomes "cool," "one of us." This is not something to be necessarily frowned upon, as teachers, too, are only human and wish to get along with their students, but it can be quite problematic being the teacher to your Friends. A certain distance needs to exist in order for teachers to conduct themselves with objectivity and manage a class fairly. Repeated interaction can whittle away the teachers' authority, as another effect of social networks is to disperse power from the center to the margins (Doyle & Fraser, 2010).

Thus, the greatest disadvantage to the teacher-student relationship on Facebook is that it inevitably leads to a change in the teacher's role in the classroom. It is difficult to remain neutral towards one's students as is, let alone if we compute a closer relationship between certain students and their teachers on Facebook. It is from this neutrality that the success of all the other roles derives, namely mentor, facilitator, manager, assessor, etc.

4. Final considerations

"Hello, what is the exam date again?" is only a generic question, a general way of trying to encapsulate all the issues surrounding the Facebook-mediated teacher-student relationship, as faced and observed by the author of this paper.

On the one hand, it almost goes against the grain, not to mention impossible, to keep this relation isolated from the benefits of technology. Two of the most significant advantages bestowed by Facebook, mentioned in this paper are instant, effortless communication at the tips of one's fingers, a way of addressing a multitude of people in a single stroke; and the potential for great visibility through the existence of networks around each node in one's Friends' List, which could help propagate knowledge and information. Researchers, however, have found out that, unfortunately, despite this tremendous possibility, information becomes stuck in networks rather than spread freely (Barabasi, 2011). This leaves the Friends' List as playing another role altogether, namely that of the audience holding the power of the "Like" button.

One the other hand, there are consequences to inviting students into one's social network. Firstly, linked to communication, the perceived availability of Facebook apps, such as the Messenger, together with the effects of online disinhibition, almost invite students to encroach on the teachers' private lives as they try to solve personal or academical problems. Connected to the

Friends' List, teachers opening up their personal accounts and networks to students, who are more or less a transient public, allow students to see and think of them in environments that might not always be professional, thus fostering a "Friendliness" with their students that is slowly adding to, and actually changing, the roles that the teachers have to fulfill in class, but also the relationship they have with their students.

Whether or not this direction is something we can influence or just another thing we have to adapt to remains to be seen.

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Preserving Monuments In The Memory Of Local Communities Using Immersive MAR Applications as Educational Tools

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Abstract

This paper presents and analyzes a set of e-learning applications implemented with the objective of education of a rural community regarding the local heritage. These applications combine two Mobile Augmented Reality (MAR) paradigms in a continuum with the purpose of creating immersive environments for enhancing learning in situated contexts.

Keywords: local heritage, Mobile Augmented Reality, immersive environments, mobile learning, situated-learning

1 Introduction

A primordial issue concerning the protection and rescue of monuments is the degree of awareness and involvement of local communities, as stressed by the La Valetta convention (La Valetta, 1992). The present paper will show an example of this cultural strategy applied in a European traditional peasant community, i.e. in the village of Vădastra, in Southern Romania, near the Danube River, using immersive environments.

The first author has for more than a decade organized annual campaigns of experimental archaeology in the village, with the purpose of transferring the ancient technological know-how back to the community (Gheorghiu, 2001), in order to revive the old crafts specific to the region. For the beginning of this project see also (Gibson, 2002). Ancient technologies of the local populations were studied, especially the ceramics, whose technology was taught to young villager during summer courses (Sârbu and Gheorghiu, 2007), with the objective of revitalizing this skillset and trade and to create a local craft industry.

In the case of the Vădastra village we have used a pedagogical approach based on information augmentation techniques and user's immersion in a mixed reality environment, because of their educational benefits; the tools and techniques employed include Augmented/Mixed Reality (AR/MR) and mobile devices, first to reconstruct the specific layers of dwelling of the site, i.e. the Chalcolithic and Iron Age layers, and then to reveal the areas requiring protection in an intuitive and immersive manner.

This paper will discuss different pedagogical approaches and solutions, and will present a case study of a complex educational experiment carried out in Vădastra village during 2012 and 2013, within the research project on immersive applications as educational tools.

2 Immersive AR/MR Paradigm for Mobile Devices

Among computer-supported methods of augmentation Augmented Reality (AR) technology creates an enhancement of the reality with virtual information (Azuma et al., 2001). Augmented Virtuality (AV) is a virtual environment augmented with content from the real world. In Milgram and Kishino (1994) was proposed an integration of the two paradigms under the term of Mixed Reality. If mobile devices are the platform, the paradigm is Mobile Mixed Reality (MMR) (Karlekar et al., 2010).

For our objective of educating different age groups of the traditional community in the spirit of protection of the material and immaterial heritage, we considered the MR techniques adequate because of their rich and easily accessed content. The computer-generated content (text, images, 3D content, sounds, video) can be overlapped on a live scene view, generally captured with a video camera, and reversely, can be integrated (e.g. videos) into virtual reconstructions (Costanza, Kunz and Fjeld, 2009). Performed in real time in the field, at school or at home, these processes produce an enhanced view of the real scene, allowing an augmented perception "beyond normal" (Karlekar et al., 2010) and consequently a comprehensive understanding.

2.1 AR Technology

The current IT environment is characterized by an extraordinary spread of mobile intelligent devices (smartphones, tablet PCs) with powerful computing and connectivity capabilities, available at competitive prices, which enable the mobility of the users accessing digital resources.

Augmented Reality for mobile devices (MAR) (Butchart, 2001) is at present a driving technology for developing mobile applications that can deliver virtual information overlaid on the real life context. These applications fully exploit the technological affordances of the intelligent mobile devices: the 2 video cameras (front and rear), the GPS receiver, the magnetic compass, gyroscope and accelerometer, integrated on a single and portable device.

MAR applications can identify the context either by means of its natural characteristics or with visual markers, in which case the context is what the user sees, or by means of geographic data, when the context is location-based, revealing where the user is. In the former case, MAR is called "Image recognition AR" (Madden, 2011). In the latter case, MAR is called "Geographic AR" and uses the concept of Points of Interest (POIs), similar to Google Maps' POIs, to which the augmented information is attached (Madden, 2011). A group of AR POIs represents an information layer with a specific meaning.

2.2 Similar Work

For these reasons, MAR has been used both in primary and high-education (Billinghurst, 2002; Rose, Potter and Newcombe, 2010). Educational usage of AR in the domain of history and heritage is presented in Wheat-Stranahan et al. (2007), Hermon (2008), Lopez-Nores et al. (2013), Politis, and Marras (2008), Stricker et al. (2011), Pozzi et al. (2011), Gheorghiu and Ştefan (2012), Gheorghiu, Ştefan and Rusu (2013), Maiorescu and Sabou (2013). Unlike other works, the approach in our research was to exploit both MAR paradigms, to make a merge and have the best of both.

3 MAR Educational Applications

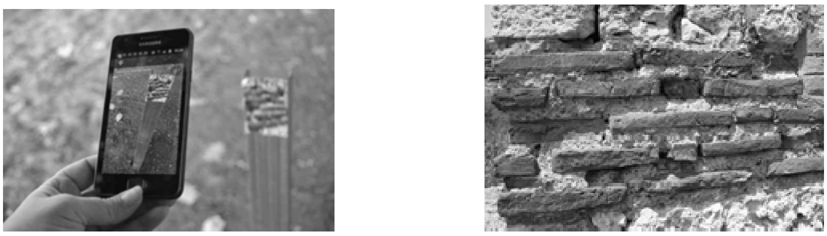
The development of applications capable to use MAR capabilities represented our applied stage of our strategy to educate the Vădastra community, with a special focus on children from the local Secondary School. The idea behind these MAR applications was to present images of the archaeological record and 3D reconstructions of objects and buildings in their geographical context with the goal of initiating on-site learning and developing the children's awareness of the local history.

3.1 Implementation Details

For the purposes of our pedagogical strategy two mobile applications were developed: a geographic AR (Figure1) and a marker based image recognition AR (Figure 2a) using the Layar

AR platform and browser (Layar,2015;Madden,2011). Consequently the augmented information could be presented to the user by search of the historical context and also by identification of the representative visual markers (Figure 2b). The applications were tested on Android smartphones, but they can also be accessed from iPhones.

Figure 12. **Use of applications in the geographical context**



a) b)

Figure 13. **Image recognition and the image used as visual marker**

We considered that two layers of dwelling, a prehistoric and a Roman one, would be specific for the Vădastra village. In this perspective the identified locations, a part of the settlements of the Neolithic village and a Roman *villa rustica*, which partially overlapped the former, inside and around the village, were geographically marked on the site using a smartphone with GPS receiver and afterwards accessed from the AR application. A free application available on Android smartphones with integrated GPS receiver was used to collect the geographic coordinates of these most important archaeological locations. Using these geographic data, several POIs were defined (Figure 3a), to which explanatory texts, 2D images and 3D reconstructions as virtual augmentations and explanations were attached (Figure 3b).

a) b)

Figure 3. **List of POIs and virtual augmentations of the geographic POIs**

To confer a greater visual definition to the reconstruction of the context, a series of video films were also produced, displaying the technologies underlying the reconstructed objects (Figure 4). These movies, produced under the form of re-enactments of the technologies specific to each dwelling layer, are themselves pedagogically efficient. The movies were performed by groups of experimentalists coordinated by the first author, and observed the *chaînes-opératoires* of each of the technologies. Furthermore, the filming was performed to clearly present each technical operation and to facilitate the learning of the technological gestures.

Figure 4. **Technologies explained with video augmentations**

With the pedagogical goal of suggesting an archeological stratigraphy we presented two images of overlapped layers of occupation, attached as augmentations to two nearby POIs, for a more immersive effect (Figure 5). To obtain the desired effect, we adjusted the visualization angles and image scale in regards to the user's position and orientation.

Figure 5. **Overlapping of augmentations for a more immersive effect**

To define the visual context (Figure 6), the prehistoric settlement and the Roman *villa rustica* were marked with wooden markers. On each of its sides two images were attached representing two material textures specific to the two historical periods: textures of the ceramic bricks for the Roman period, and a mixture of clay and straws, for the prehistoric period. These images contained a broad variety of details and contrast colours and are used as visual markers. When scanned with the video camera these images were able to trigger the augmentations (the virtual objects representing 3D reconstructions of an architectural object seen from the front) (Figure 5).

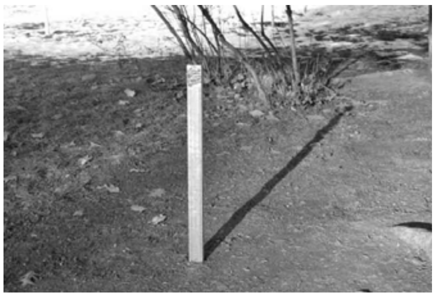


Figure 6. **The archaeological context for the MAR applications**

4. The Pedagogical Scenario

In the "Geographic AR" application, the virtual information suggests an archaeological stratigraphy. As the user approaches the center of the marked area, these images grow in size, finally occupying a larger area of the screen. To advance the learning of the local history, beside the image visualizations, the user can initiate certain actions such as playing a movie displaying a 3D virtual tour of a prehistoric house or of the Roman *villa rustica*, or watching a video on the technology of the manufacturing of prehistoric or Roman furniture (Figure 7a).

a) b)

Figure 7. **Roman furniture and a reconstructed Roman furnace**

Upon coming closer to the indicator, the user becomes able to scan one of the images from a relatively short distance, the user can commute on the "Image recognition AR" application and see a 3D model of an architectural object (e.g. a Roman furnace) (Figure 7b), corresponding to the historic period represented by the image. This transparent reconstruction overlaps the image captured by the video camera, providing a realistic and immersive augmented view in an authentic historical place.

5. Discussion and Further Work

The children from the secondary village school experimented learning with the MAR applications (Figure 8) using the devices offered by the research project, with Internet connectivity and 3G communication from a local mobile operator.

Figure 8. **Children using MAR application near a prehistoric settlement**

The children were able to quickly learn the new visual paradigm offered by the AR application, and to explore in an interactive way their historical context, using the information provided by us. With this pedagogical method an economical limitation existed. The smartphones are expensive equipment for economically disadvantaged communities, and the broadband Internet connectivity (Wi-Fi, 3G) can raise the overall costs of the learning solution. In our case, the costs were supported within the research project on the use of immersive applications as educational tools. Tablet PCs with auto-focus camera and GPS receiver can be used as a more affordable alternative, and the applications were further tested on such larger-display devices.

The implementation of virtual immersive environments rises technical challenges regarding the quality of the immersion, but also pedagogical ones, such as how to preserve learners' motivation, or determine users to reuse the virtual learning environments. Different solutions can be applied, essentially with the objective to engage and retain learners. For our strategy we chose to implement a situated learning and to create pedagogically significant augmentations, able to immerse the learners in the recreated mixed reality. We evaluated the learning outcomes through an educational blog on Google+ (Gheorghiu and Ştefan, 2013).

6. Conclusions

In this paper we presented a study case of learning with MAR applications as immersive, inquiry-based and situated instruments.

The mobile devices, i.e. smartphones and tablet PCs, are modern educational tools with social potential and significance. The situated learning paradigm using mobile devices and AR as a modern visualization tool has demonstrated its pedagogical efficiency: children were involved in an in-situ exploration for the archaeological POIs and the stratigraphic image of the site and the 3D and video reconstructions of the contexts created a new MR view (rural landscape, virtual objects and video records), with strong impact on their overall understanding of the topic. During the experiments we could observe that children learned while also involved in recreational activities (Politis and Marras, 2008) outside and independent of the classroom settings. The experiments with the mobile learning also illustrated the efficiency of immersion in learning processes.

To conclude, we can state that immersion resulted from combined use of different solutions of mixed real-virtual environments had a strong impact on the community, and achieved our educational goals, namely to teach local history, ancient technologies and to preserve for the future the material and immaterial local heritage.

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Effective implementation of eLearning - Romanian Language and Literature Classes for University Students in Serbia

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Abstract

The aim of this paper is implementation of new technological possibilities in the process of learning Romanian language and literature at Faculty of Philosophy in Novi Sad. eLearning at universities in Serbia is not frequent. Some technical faculties have good equipment but the rest of them cannot boast with good technical tools for eLearning, actually we do not have it at faculty level. Teachers are forced to introduce eLearning as much as possible if they consider that this will assist in the process of teaching. For that reason, the lessons of Romanian language and literature are enriched with additional activities – Useful implementation of eLearning. The whole process was monitored for two years. Possibility to choose the way and to use various tools for homework, essays, communication encouraged the students. The results of this study showed that most popular tools are Web 2.0 (social networking sites, blogs, wikis, video sharing sites, hosted services, web applications). Some programs require extended students' depth of knowledge in the content areas. Student's motivation and interest for learning increased.

Keywords: eLearning, Implementation, Process of Teaching, Romanian Language and Literature

1 Introduction

eLearning is an increasingly frequent subject of discussion at universities in Serbia. Technical universities, since it is part of their field, can boast of implementation of advanced technologies, such as eLearning and distance learning. Other faculties cannot provide excellent technological equipment. However, students are increasingly interested in new, modern ways of learning. Therefore, teachers must adapt and offer students all the possibilities that can meet the needs, at least partially. Faculty of Philosophy in Novi Sad, Serbia is well equipped. Each classroom has a computer, projector and four classrooms have smart boards. It often happens that teachers are not sufficiently motivated and trained to use even basic equipment which is offered daily. Faculty management, Vice-Dean for Education, often organizes training for computer skills and working on the smart board. Nevertheless, students increasingly require making the material online available, using social networks in educational purposes, communication and consultation with teachers through social networks, the use of blogs and web applications. Growing interest in the Web 2.0 tools.

2 Literature review

Quality of learning is a major concern for students, their parents, prospective employer, government, and society, in addition to the academic administrators and teachers. Quality is a condition for the success of products in general and quality becomes essential in the field of education in particular (Schreurs & Al-Huneidi). In young ages especially, children can use the huge interactivity of new media, and develop their skills, knowledge, and perception of the world, under their parents' monitoring, of course (Mahanta & Ahmed, 2012).

The World Wide Web has become an increasingly powerful, global and interactive medium for sharing information. The advances of web technologies have boosted development of new learning experiences for students. One of the first types of web application for delivering instruction via the Internet is web-based instruction that is now known as e-learning (Surjono, 2014).

Technology in classroom implies the effective use of technological tools in learning. Educational technology also called e-learning is very important in every part in educational, modern today's life. Students are increasingly using modern technology, not only for learning but also in social, everyday life (Janjić, 2015).

E-learning includes all forms of electronically supported learning and teaching. The information and communication systems, whether networked learning or not, serve as specific media to implement the learning process (Mahanta & Ahmed, 2012).

e-Learning has attracted considerable research and development funding and commercial interest. This has fuelled the creation of a significant body of books, refereed and professional journal articles and reports, and commercial and other Web resources that provide reports of practice, and guidance for the development of e-learning experiences. At the generic level there are a number of implicit and explicit frameworks designed to inform e-learning practice. Founded on earlier theoretical frameworks, or on empirical studies, they identify the factors that need to be considered in pursuit of the creation of good quality e-learning experiences (Gilbert et al, 2007).

Lifestyles and, especially, educational systems giving high priority to using technology as a tool to support the learning processes and to provide learners with the latest professional technological skills (Rhema & Miliszewska, 2011).

Instructional technology and elearning are the key focus of educational teaching, learning and pedagogy. It is associated with lot of innovations and pool of knowledge that provides student with learning experiences at their convenient. The technological innovations of e-learning is altering and profoundly influencing the way teaching and learning are impacted, it is re-defining classroom teaching and learning to extent of its scope, boundaries and pedagogy (Odunaike et al, 2013).

Essentially, e-Learning is another way of teaching and learning. In its broadest definition, e-Learning includes instruction delivered via all electronic media (Govindasamy, 2002).

It afforded alternative ways of communicating with teachers and fellow students, provided a greater variety of learning resources and modalities, extended the flexibility and quality of group-work, and improved the opportunities for providing students with feedback on assessment tasks (Rhema & Miliszewska, 2011). Many proponents of e-learning believe that everyone must be equipped with basic knowledge in technology, as well as use it as a medium to reach a particular goal and aim. Learning is the key to achieving our full potential. Our survival in the 21first century as individuals, organizations, and nations will depend upon our capacity to learn and the application of what we learn to our daily lives (Mahanta & Ahmed, 2012).

eLearning achieves its potential when used repeatedly over time and place by engaged participants. Engaged people seek online lessons and references—and now, in this Web 2.0 world, they also contribute generously, making choices to both consume and create resources (Rossett and Chan, 2008).

3 Useful achievement of eLearning - Romanian Language and Literature Classes: Case Study

Already the first studies (Popović & Janjić, 2012; Janjić et al, 2012; 2013b; 2014c; 2015d; 2015e; 2015f) have shown that introduction of technologies into classes of Romanian language and literature yielded positive results. Professors who have introduced various forms of e teaching and learning, at first could use existing technological knowledge and to apply it in the teaching process. Nevertheless, the needs of teachers and students increased. Students realized that there are opportunities for eLearning with certain professors and progressively more insist on it. Teachers on the other hand, needed to be more educated in the use of technology by taking an exam and obtaining the *ECDL* certificate. Faculty of Philosophy in Novi Sad recognized the needs of its professors and organized a free education for obtaining the *European Computer Driving License,* as an authorized institution for of taking this exam. Professors continued training by attending courses and workshops that provide more information about eLearning in the process of teaching and learning. One of the latest is the use of smart boards in teaching process. The latest research related to effectiveness of eLearning in the process of learning, as an additional and partial component of teaching and learning, afforded encouraging results. More and more often in the course of teaching Romanian language and literature, but also outside the official classes, were used various forms of e-learning.

3.1 Communication and access to information

The exchange of information is very important in the learning process. When students are informed and instructed in the learning material, motivation grows and the results are better. The best method that gives effects in communication students - professor is Facebook and between professors is email and not so often Facebook. Compared to the first research conducted in 2012 (Janjić et al, 2012), the number of students who used this social network in 2015 has increased considerably.

The reason why students most often communicate with teachers via these social networks are usually the same: *They are not under stress when they write on Facebook*, *have a sense of closeness and friendship with the professors*, *have the feeling of being accepted, the perspective that is closer to them, it's not necessary to pay attention to the official and limited correspondence.*

At the beginning teachers were incredulous in presenting information on Facebook, as is shown in the survey from 2012 (Janjić et al, 2012), but after certain time realized that all students look for information online, asking questions in groups specifically made for it, reading the postings of their professors, discussion through comments. Therefore the professors part of their free time devoted to publishing posts about the teaching subject at Faculty. These are the most interesting facts about Romania, Romanian language and grammar rules - illustrated by photos, Romanian passages from the literary works - processed at the university, songs, poems, cultural events. The professors of the Romanian language and literature at Faculty of Philosopy daily share links for grammar learning, practicing and reading, also for online reading the books of Romanian writers. In the end it turned out that the students are much more informed and acquainted with the material and with the knowledge of Romania

3.2 (Online) task assignments

Ability to send task (homework assignments) online or to present through a blog or groups on any of the social networks has opened a lot of possibilities. Also, students selected various programs and presented their tasks. Until 2015, the most common used is Power Point (95%) but from this year there are also *Prezi* and *Smart Notebook. O*f course, these programs do not replace Power Point or *jeopardize* its use, although offered new technological improvements.

3.3 Mobile learning

On the classes of Romanian language and literature becoming widely used mobile phone as an aid in learning. Due to the lack of modern dictionaries and grammars, books for reading, teachers are forced to use the electronic versions and to supply students. Often, these versions are adapted for a mobile phone. Students most often use DEX and Google for translation and explanation of unknown words. Certainly, these two programs cannot be compared. DEX does not provide translation but an explanation in Romanian, from the other side Google translate provides faster but often incorrect translation.

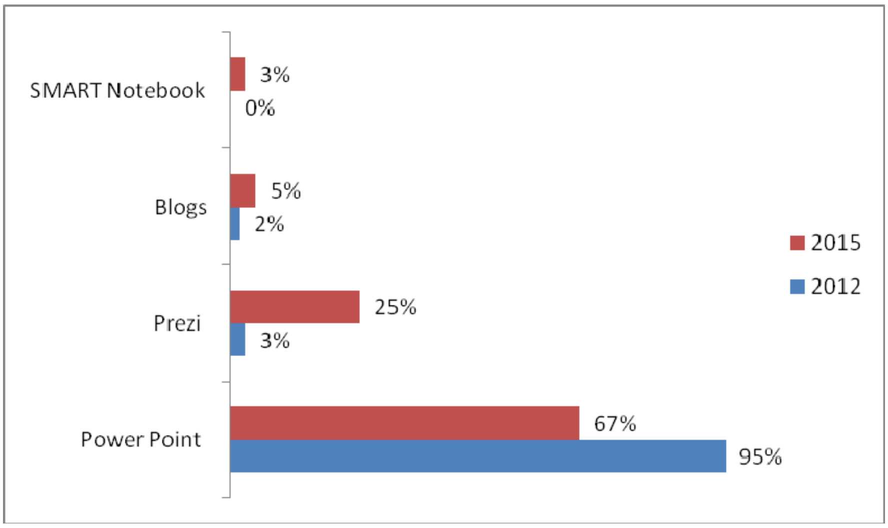

Figure 1. **Programs usage statistics in 2012 and 2015, for tasks presentation.**

Last year, more students use mobile application for learning Romanian language. They use applications during the breaks between learning process, between lectures and at lectures. The benefit of this learning was also presented during 2015. and this research (Janjić 2015) has given great results.

3.4 eBooks and Internet Public Library

Due to the lack of books at the Department of Romanian studies, professors have explored a whole new world of electronic books. Students require specific books that are related to learning Romanian language and literature and professors offered them a solution that would satisfy their needs. Research (Janjić & Popović, 2015) was carried out about electronic libraries from Romania and opportunities for students in Serbia.

A large number of books needed for teaching and studying Romanian language, is available online. Students were asked to search themselves and to sail into a new world. According to the survey, more than 80% of students use e-books available on the Romanian sites. Links of available books can be found in groups on social networks and blogs. The most visited Online Libraries in Romania are: *County Library George Baritiu - Brasov; Central University Library of Bucharest; National Library of Romania; Romanian Academy Library; County Library Octavian Goga – Cluj; Arges County Library - Dinicu Golescu; Central University Library Eugen Todoran – Timisoara*.

4 Conclusion

Implementation of all possible and available elearning tools, facilitate the process of teaching. For students eLearning teaching process is more interesting, they have more learning materials, and most important, everything is available in the form most suitable for them. Based on the survey whether the implementation of eLearning have effective influence the process of studying the majority of students responded (82%) *that helps them a lot*. All this have influence on improving the relationship between students and professors. Students at the end of the semester conceptually described the possibility of eLearning (Figure 1).

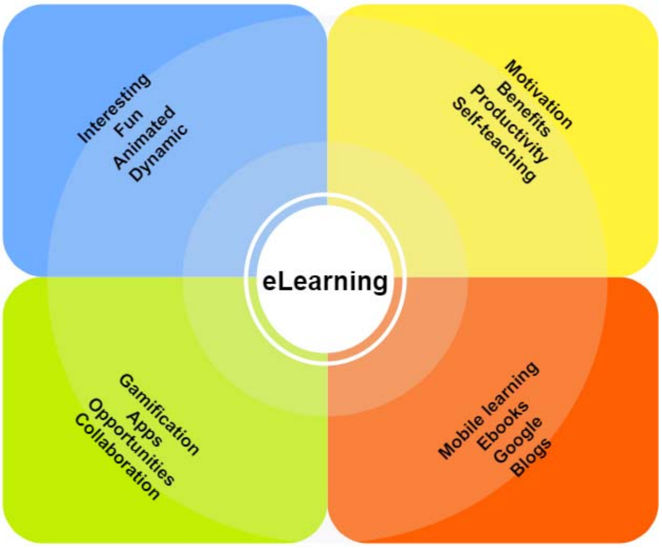

Figure 1. **Possibility of eLearning - students' opinions**

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