The 11th International Conference on Virtual Learning
VIRTUAL LEARNING – VIRTUAL REALITY

Phase II - Period 2010-2020: e-Skills for the 21st Century
Phase III - Period 2020-2030: Intelligence Learning –
Knowledge Society and Learning Culture

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ICVL 2016 dedicated acad. SPIRU C. HARET (1951-1912), Romanian education reformer

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

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Proceedings of the 11th International Conference On Virtual Learning

OCTOBER 29, 2016

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

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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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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"

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

October 29, 2016 – CRAIOVA, ROMANIA

Location: University of Craiova, Faculty of Sciences - Department of Informatics, ROMANIA

Organizers: University of Bucharest, University of Craiova – Department of Informatics

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.

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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), Virtual Laboratory (VirtLab), 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 (CG) 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 & VIRTUAL LABORATORY (TECH)**
- **SOFTWARE SOLUTIONS (SOFT)**
- **"Intel® Education" – Innovation in Education and Research (IntelEdu)**

Objectives

2010 – Towards a Learning and Knowledge Society – 2030

Phase II - **Period 2010-2020**: e-Skills for the 21st Century
Phase III - **Period 2020-2030**: Intelligence Learning – Knowledge Society and Learning Culture

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), Digital Agenda-Europe 2020

- 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, Virtual Reality and Virtual Laboratory.
- 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 & Virtual Laboratory (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, Virtual Laboratory, 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

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

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
- Virtual Laboratory and Technologies

- 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

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

Educational Technologies to Support Medical Education

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Abstract

Technology has changed the landscape of teaching and learning. The integration of educational technology into teaching for meaningful learning is an issue for all educators to consider. This paper aims to make an analysis of the most successful medical education technologies, based on information and communications, used in modern medical education, methods validated by educational science experts, by identifying those which can help to improve the healthcare education in Romania. In the first part of the paper are introduced a number of modern educational technologies used in medical education including: web-based applications, blended learning, mobile learning, massive online courses. The second part of the paper it is assigned to the the listing and describing of the most popular virtual patient software applications.

Keywords: Medical Education, Virtual Patients, Simulation

1 Introduction

The outstanding development of computing power, of storage capacities along with the communications revolution and widespread expansion of Internet connections has led to an unprecedented technological revolution.

Education, as a defining element in the evolution of a society, could not be bypassed by the technological progress, by knowing fundamental changes that determine the development of new methods, models and paradigms for modern education. Radical changes have emerged in the approach of education starting from primary education up to university education and even lifelong education. By doing this, the era of "digital native" has brought, in addition to the digital revolution, an educational revolution in all its fields: science, engineering, economics, medicine and even art, music or literature and foreign languages.

The medical field is a special field that shows specific features of which the specialists in educational sciences must be aware and for which they must identify the best solutions in order to implement a modern and efficient medical education.

2 Materials and Methods

For the preparation of this study, we made an analysis of educational technologies by focusing only on those which, according to numerous studies and statistics have been proven effective in medical education. In this regard, we made a classification of these new technologies based on the following criteria: place, time and type of delivery and management of the educational process. Based on the mentioned categories, the following criteria were taken into account (Table 1).

Table 1. Educational Technology Criteria Classification

Place and time of learning	Type of learning	Platform
Face-to face instruction Distance learning: Syncron Asyncron	Visual/Auditory/Kinesthetic Linear / Ramified Individual / Collaborative	Computer-based learning Web-based learning Mobile-learning Manikin simulation

In the second part of this study, we investigated the most popular applications of Virtual Patients (VP). In this regard, we chosen from available solutions five VP applications that meet MedBiquitous specifications.

The MedBiquitous Consortium develops information technology standards for the healthcare domain. In an effort to promote the widespread use VP in all medical fields and at all level, MedBiquitous developed XML-based “MedBiquitous Virtual Patient Standard” (MVP) to enable interoperability, exchange and reuse VPs across systems and platforms [Medbiquitous, 2016]. XML was chosen as the basis for specifications MVP due its wide use and compatibility with existing standards [Triola, 2002]. The standard comprises five components which are intended for: (a) integration into the technical architecture of implemented eLearning platform; (b) export for stand-alone use with a virtual patient player (Table 2).

Table 2. MedBiquitous Virtual Patient Standard

MVP Components	Description
Virtual Patient Data (VPD)	Medical history, physical examination, diagnostic tests, interventions, differential diagnose
Media Resources (MR)	Images, animations, video, audio files
Data Availability Model (DAM)	Makes connection between VPD and MR
Activity Model (AM)	Determines how the student interacts with VP case: observation, diagnosis formulation, decision making
Global State Model (GSM)	Establish integration into LMS platforms

3 Educational Technology

"*Educational technology*" is a term which covers the physical component of education (hardware) and as well the educational theories. As a result of the digital revolution in modern education new terms and paradigms have emerged as like eLearning, multimedia learning, technology-enhanced learning (TEL), computer-based instruction/training (CBI/CBT), computer-aided instruction (CAI), internet-based training (IBT), web-based training (WBT), online education, simulation-based learning, computer-mediated communication, cyber-learning, networked learning, virtual learning environments (VLE), m-learning, blended learning, digital education.

The academic and professional organization Association for Educational Communications and Technology (AECT) defines the "*educational technology*” as "*the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources*".

From a technical point of view, digital education can take various forms: ***synchronous*** (online real-time live teacher instruction and feedback, Skype conversations, chat rooms or Virtual Classrooms where everyone is online and working collaboratively in the same time) or ***asynchronous*** (MOOC, e-mail, blogs, wikis, discussion boards, audio video courses, social networking); ***linear*** (computer-based training) or ***ramified*** (case studies, virtual patient); ***individual*** (computer-based instruction) or ***collaborative*** (Computer-supported collaborative learning, multi-user virtual environments); ***blended learning*** (B-Learning) or ***mobile learning*** (m-Learning) [Vlada, 2011].

From a practical standpoint, in our study we identified three domains of applicability of educational technologies in medical education*:*

1. technologies for face-to-face instructions;
2. technologies for online education (web-based applications);
3. technologies for simulation-based training;
4. technologies for education management: online task, assessment, evaluation, administration functionality

3.1 Technologies for face-to-face instructions

Technological advances in the field of online education can not replace face-to-face instruction in almost any domain and even less in medicine, dentistry, nursing or pharmacy. The information obtained in the classroom, the clinical examination , medical imaging or laboratory date can be supported by educational technologies including: audience response systems (ARS); interactive whiteboard (IWB); case based learning (CBL); problem based learning (PBL).

PBL allows students to test their understanding of topics through facilitated discussion, and to integrate material from different disciplines/specialties [Wood, 2003].

The advantage in CBL is its ability to model the process of accessing information and solving medical problems which are the core activities of most physicians.

3.2 Technologies for online education

Table 3. Technologies for online medical education*

Massive Open Online Courses - MOOC
Medical Courses from Coursera, EdX, Khan Academy, Udacity, Canvas: • Health Care Systems (Stanford) • Medical Neuroscience (Duke University) • Clinical Problem Solving (University of California San Francisco) • Anatomy of the Abdomen and Pelvis (Leiden University)
Mobile Medical Education - MoMEd
Mobile Apps developed by medical institutions • NeuroExam Tutor, University of California, San Francisco School of Medicine; • Osmosis web- and mobile-learning platform, developed by Johns Hopkins medical students and used by more than 20,000 medical students. *Standalone applications:* • Pocket Medicine Red Book for Android - provides key clinical information and solutions to common problems faced in the practice of internal medicine; • Medscape - a drug reference application; • Essential Anatomy from 3D4Medical; Human Anatomy Atlas. *Applications to access the others apps:* • Skyscape - offers access to a robust selection of medical calculators (Archimedes), periodically updated medical news alerts, select practice guidelines, access to paid textbooks (like Netter's), and solid drug reference (RxDrugs) and disease monographs (Outlines in Clinical Medicine); • MedHand, Dr.Companion. *eBooks:* • British National Formulary (BNF); • Netter Atlas of Human Anatomy (NETT); • Oxford Handbooks of Clinical Medicine/Surgery/Laboratory Investigation;

• Oxford Handbook of Medical Sciences (OHMS).
Podcasting
Podcast Library for Medical Education • Instant Anatomy Podcast - human anatomy for doctors, medical students, nurses; • Carl Jung's Analytical Psychology - the fundamentals of Analytical Psychology; • Anesthesiology News Podcast Library; • Cardiology Podcasts from iTunes; • Dermatology: Medscape Podcast; *Streaming, recording and editing sounds/video* • BroadCam Video Streaming Software; • Audacity.

** Please note that these examples are for illustrative purposes only. Many other equally meritorious examples could have been cited.*

3.3 Technologies for simulation-based training

Medical simulators development has been an unprecedentedly advance in the medical students training. It has allowed professors the opportunity to teach the fundamentals of medicine and to transfer their knowledge to the students.

Along with the rapid evolution of technology, medical simulators have become more and more performant, managing to reproduce the human's body as a complex "diseased" system which might be "cured" only by applying the right diagnosis. Simulators as one device, or by hardware and software components, are quite expensive to purchase but usually they can be utilized for many applications. For example an endoscopy simulator may be used to teach esophagogastroduodenoscopy and colonoscopy to gastroenterology trainees, and bronchoscopy to critical care trainees and laparoscopy to surgery trainees using specially designed components for each investigation, like different software programs, different anatomic plates or scopes [Desilets, 2011].

Simulator devices allow to not only to learn to think and diagnose, but also show indications and contraindications, simulate complications when procedures are not adequate applied and display information about the procedure and its complex effects on patients. Simulator main advantage is that it can be used as a training tools to simulate a wide variety of pathologic conditions but studies showed that the performances of simulator-trained learners are improved only in the learning first stages [Sturm, 2008].

Computer-based virtual patients (CBVP) or Virtual Patient (VP) was the second approach designed to provide safe and efficient means in order to develop the medical students' knowledge, skills and clinical judgment (Table. 4).

As is specified in MVP Standard, VP represents "*an interactive computer simulation of real-life clinical scenarios for the purpose of medical training, education, or assessment*" [Medbiquitous, 2016].

Table 4. Technologies for simulation-based training*

Virtual patients (VP)	
Products	**Specific Examples in Medical Education**
• CASUS • CAMPUS • IVEMDS • OpenLabyrinth • UltraSIM • Web-SP • vpSIM • OpenTUSK	Institut Universitaire Santé Travail Environnement d'Alsace (IUSTE), Strasbourg, France AG Arbeits- und Umweltepidemiologie, Net-Teaching, Munich UMF "Victor Babes", Timisoara, Romania Unitat Docent Parc Taulí, Badalona, Spain University of Zaragoza, Zaragoza, Spain Birmingham Heartlands Hospital, Birmingham, UK University of Amsterdam, Netherlands

** Please note that these examples are for illustrative purposes only. Many other equally meritorious examples could have been cited.*

4 Computer-Based Virtual Patients

New advanced technologies were developed for making available for learners great amounts of information in compressed periods of time and then to offer them the possibility to apply the achieved information and take complex medical decisions while concerning about patients as teaching subjects.

Taking in consideration that in medicine most of the cognitive errors arise from unprecise interpretation, synthesis, and unexperienced logic, rather than lack of data [Chu, 2012], VP are extremely important for students because different virtual cases can be developed in order to reproduce real-life clinical scenarios and while they are reaching core knowledge they also improve their medical judgment.

A large number of virtual patient simulation applications were designed to enhance education on medical universities and clinics. As teaching and training tools these technologies are used by clinical trainers to build a wide variety of pathologic conditions and case scenarios. The most popular platforms are: Web-SP, CAMPUS, OpenLabyrinth, OpenTUSK, CASUS, vpSim, UltraSim, IVMEDS [Doloca, 2015].

CASUS is the first VP application created in 1993 at Ludwig- Maximilians University, Germany (Figure 1). CASUS platform was developed for assisting undergraduate and postgraduate students, continue medical education (CME), but also in self-learning process and exams. CASUS is used in over 150 universities [Leung, 2011], cases have been translated into several languages, and the bank of cases currently holds over 850 [Instructag, 2016].

The **CAMPUS** system, designed especially for medical students and doctors, is introducing and presenting VP through different approaches by the means of a simulative and interactive e-learning player controlled by an authoring system (Figure 2). Additionally this system can be completed with a number of software extensions like formative, secure or full package software. This platform is mostly used by universities from Romania, Bosnia, Germany, Netherlands and Herzegovina for PBL and independent learning and provides three types of players: a Simulative e-learning one, a Web-based eViP capable one, and a summative, secure capable exam player. All these types of players can be used for learning, self-studying, formative or summative assessment or simulative and rapid e-learning. The Campus system can be used standalone, in a browser or inside a learning management system [MFH, 2016].

OpenLabyrinth is a very interesting web application which permits users to design, run and investigate pathway-based applications (Figure 3). It was designed for any professional training and educational program and is actually used by a great number of institutions worldwide for PBL, scenario based learning and independent learning [Openlabyrinth, 2016].

Web-SP platform was designed for undergraduate students, postgraduate students, CME but has a great success being used by Universities world-wide due the fact that it is available in four international languages for standalone learning activities or group learning sessions (Figure 4). The semi-linear navigation in Web-SP, the complex data acquisition (history, physical, laboratory) and feedback sections are the main advantages of this eduational tool [Karolinska, 2016].

UltraSim is an ultrasound training and simulation application for sonography education (Figure 5). This platform allows learners to practice performing sonographic examinations on a mannequin while viewing real-time sonographic images. It contains modules for abdomen, brest and thyroid examination, obstetrics and gynecology and four modules for emergency medicine: FAST, biliary, pelvic and abdominal aorta

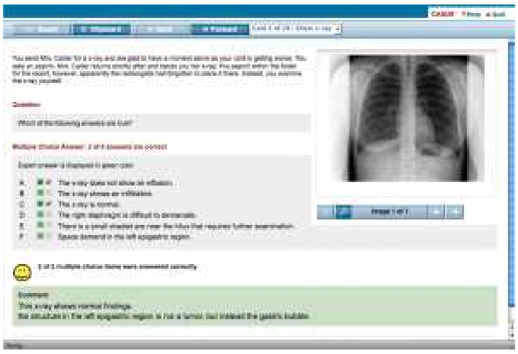

Figure 1. CASUS Sofware

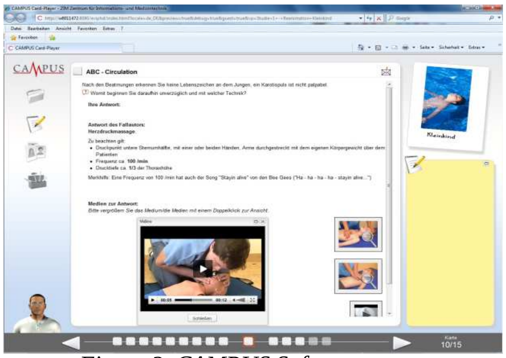

Figure 2. CAMPUS Software

Figure 3. OpenLabyrinth Software

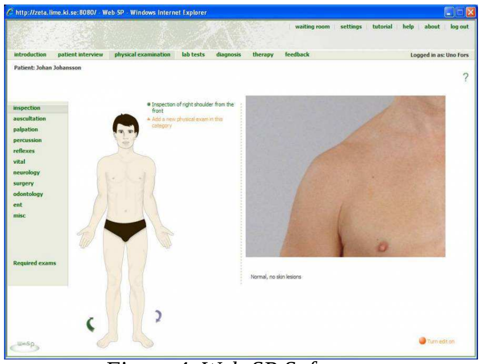

Figure 4. Web-SP Software

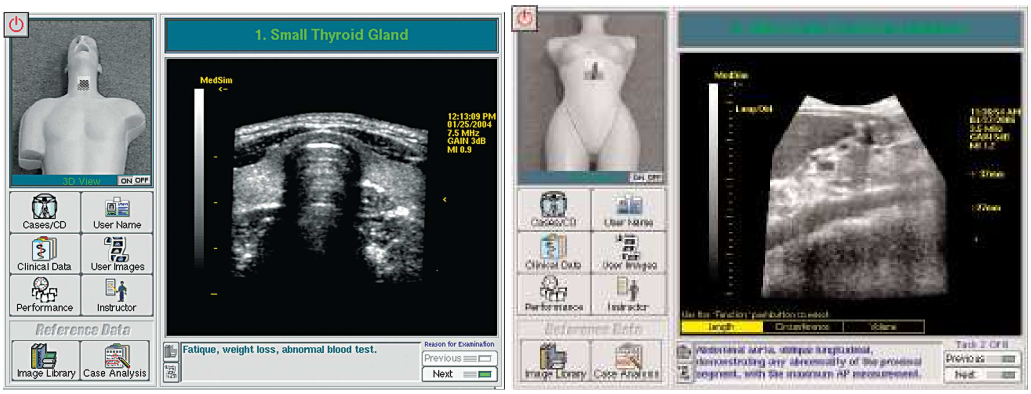

Figure 5. UltraSim Software

5 Conclusions

In medical universities, more than traditional teaching and supervised patient care, educational technologies allow individual and collaborative learning by providing relevant trainee-directed, case based learning and assessment.

Along with the rapid evolution of technology, medical simulators have become more and more performant, managing to reproduce the human's body as a complex "diseased" system which might be "cured" only by applying the right diagnosis. However, all these platforms do not replace the face-to-face traditional teaching in medicine, but in the context of diminishing appropriate real-life patients available for student teaching, time of trainers and possibilities to practice complex medical acts or lack of feedback form real-life, they can offer means to build and evaluate meaningful pedagogical scenarios and standardized, safe and forgiving settings for learners of all levels (students, undergraduate, postgraduate, residents, CME) in all medical fields, and reliable assessment of the acquired skills.

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Nonlinear models in Pharmacokinetics

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Abstract

In this article describes using the principles of the pharmacokinetics for analysis and study of drugs. They are shown modeling for absorption and elimination processes when administering a drug. The One-comportment model is studied. It describes the determination functions/models C_1, C_2 $:[0,\infty) \to R$; t-time, $C_1(t)$, $C_2(t)$ represents the time evolution of concentration of the active substance. To determine these models/functions will lead to solving a system of differential equations. To solve the system of differential equations will be used Laplace transform (linear operator). By applying Laplace transform equation system we get a system with two equations and two unknowns (f and g, functions images) L_f and L_g. For example, based on observations from experimental data it is possible to determine how to obtain the constants K_a – absorption rate constant and. K_e – elimination rate constant.

Keywords: Informatics, Computer Science, Pharmacokinetics, Math Models

1 Introduction

> Motto: "*The nitrogen in our DNA, the calcium in our teeth, the iron in our blood, the carbon in our apple pies were produced inside stars collapse under gravity. We are made of stellar matter*." Carl Edward Sagan (1934-1996), American Astronomer, cosmologist, astrophysicist, astrobiologist.

Mathematics and Informatics/Computer Science have changed methods and laboratory analysis on the assessment of medicines and clinical monitoring of drug treatments. Pharmacokinetics is a discipline that has benefited greatly from the development of theories, methods and techniques of Mathematics and Informatics /Computer Science through the computer. Today procedures for testing drugs include important results obtained in research on drugs to treat various diseases. *Bioinformatics*, *Biostatistics* and *Biopharmaceutics* are disciplines which offer various methods and analysis on the Pharmacokinetics [10].
Analysis and practice in the field of Pharmacokinetics is studying effect of administering medicines to cure disease. Administration of a drug is achieved through many ways (*injection site*) and effects depending on the active ingredient of the drug on its distribution in plasma following a *Pharmacokinetic model*:

- **One-Compartment** - Administered drug extra vascular (intramuscular, subcutaneous, rectal or oral) is distributed only in the central compartment, aqueous, intracellular and extracellular administration of the active ingredient at the site to reach plasma and undergoes absorption process (the function of variation $C_1(t)$); after which it will achieve elimination process; it says that the drug is distributed only in compartment called generic blood and the concentration of the active substance in the blood is on the function of variation $C_2(t)$;

- **Two-Compartment** - Intramuscularly administered drug is distributed into two compartments called generic blood lipids; model is characterized by variation functions $C_1(t)$, $C_2(t)$, $C_3(t)$ representing concentration of the active site administration, the active substance concentration in blood lipid concentrations, respectively;
- **Three-Compartment**- For medicinal use in low therapeutic index (e.g., dioxin, Ref. Prof. dr. Constantin Mircoiu) for the drug administered is distributed in three extra vascular compartments where the active substance concentration studying variation in three compartments: $C_1(t)$, $C_2(t)$, $C_3(t)$;

"Consider the body as a single compartment is a drastic simplification. Thus, to better absorb, drug substances should be soluble in cell membranes and thus lipophilic, and to remain in higher concentrations in the blood, should be hydrophilic. Virtually all drugs are amphiphilic, having hydrophilic part and a lipophilic part. Partly owing to the lipophilic, they will be distributed in body fat and will not follow the One –compartment model." (Prof. dr. Constantin Mircioiu, University of Medicine and Pharmacy "Carol Davila" Bucharest) [5,6].

In his doctoral thesis in 2007, Flavian Stefan Radulescu (The study pharmacokinetics of drugs with active metabolites by analyzing compartmental pharmacokinetic models and the physiological, Thesis, supervisor Prof. dr. Constantin Mircioiu), University of Medicine and Pharmacy "Carol Davila", 2007) one-compartment and two-compartment models used to study various drugs: *Diltiazem, Dezacetil-Diltiazem, N-Desmetil-Diltiazem, Loratadina, Descarboetoxi-Loratadina*, *Tramadol, O-Desmetil-Tramadol* [9]. The experimental data were processed with the solution of a one-compartment model and respectively two-compartment model for both parent drug, and for the active metabolite. In some cases experimental data could not be modeled, finding an absorption process much faster than the one considered in the planning of the experiment. Behavioral modeling results thus illustrate the multitude of alternative metabolism (consecutive or parallel reactions).

Compartmental Approach: drug distributes very rapidly to all tissues via the systemic circulation; equilibrium is rapidly established between the blood and the tissue, the body behaves like one (lumped) compartment; does not mean that the concentrations in the different tissues are the same.

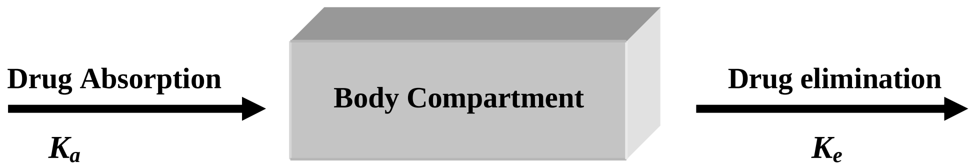

Fig. 1 One-Compartment Pharmacokinetics (PK) Model

Where constants are respectively: K_a – absorption rate constant (Hours^{-1}/Minute^{-1}), K_e – elimination rate constant (Hours^{-1} or Minute^{-1}).

Drug molecules interact with target sites to affect the nervous system. The drug must be absorbed into the bloodstream and then carried to the target sites.

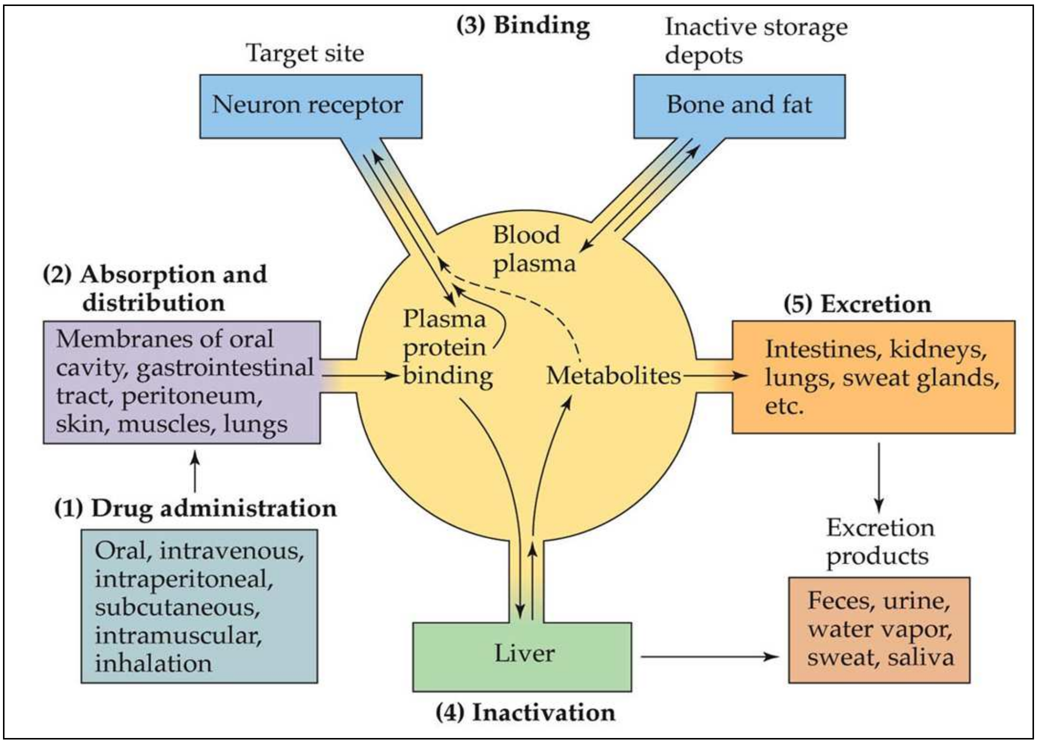

Fig. 2 Pharmacokinetics processes (from Psychopharmacology, 2005, Sinauer Associates Inc.)

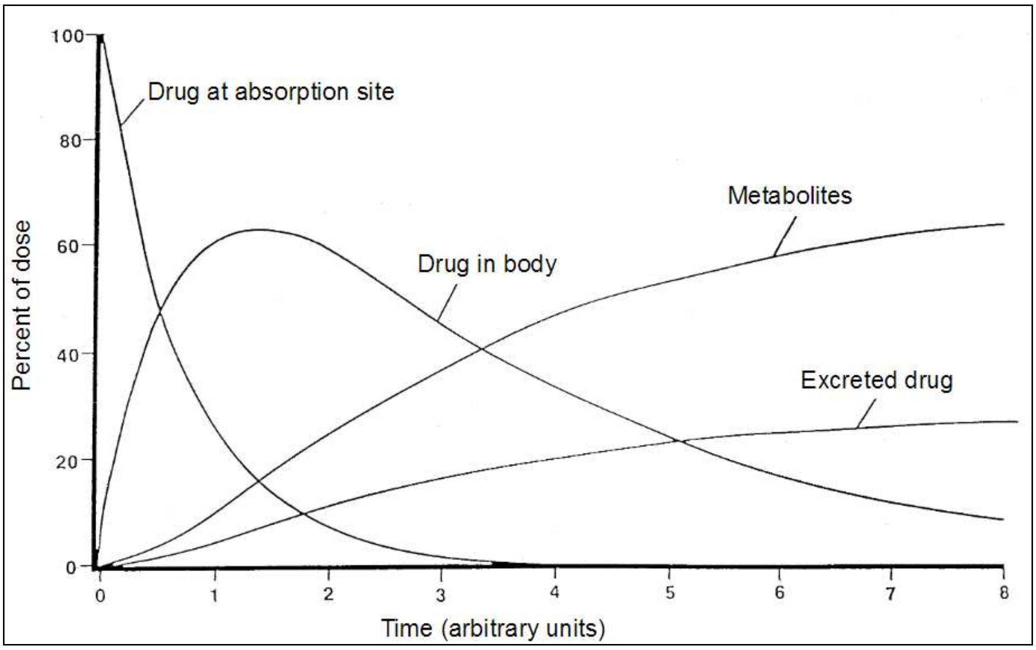

Fig. 3 Representation/Evolution of Time Profile of Drug Amounts/Concentration

Pharmacokinetics is the study of drug absorption, distribution within body, and drug elimination over time:

- Absorption depends on the route of administration;
- Drug distribution depends on how soluble the drug molecule is in fat (to pass through membranes) and on the extent to which the drug binds to blood proteins (albumin);
- Drug elimination is accomplished by excretion into urine and/or by inactivation by enzymes in the liver.

2 One-Compartment Model

We will consider if it is studying a drug administered extra vascular (EV) (intramuscular, subcutaneous, rectal or oral) is distributed only in the central compartment, aqueous, intracellular and extracellular. By action of the administration of the active substance, can be approximated as follows drug one-compartment pharmacokinetic model if between blood and extracellular and intracellular water is very quickly established a balance. One-Compartment pharmacokinetic model can be represented schematically as [2,3]:

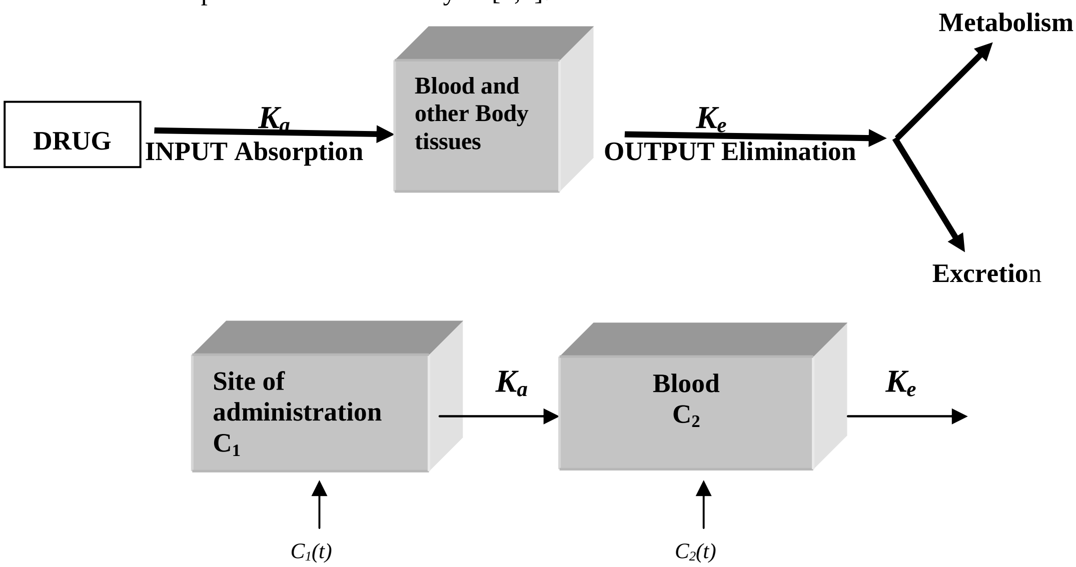

Fig. 4 Representation of One-compartment, Open model showing Input and Output

Functions/models $C_1(t)$, $C_2(t)$ represents the time evolution of concentration of the active substance. By administering the drug instead C1 (C_0 is initial concentration of the drug) triggers a *absorption process* (Absorption rate is expressed by the constant of absorption K_a) by which the active substance is removed from the deposit made at the administration and also appear in plasma initial concentration of the drug (in blood, where the first administration the initial concentration is 0). Also, it triggers a *process of elimination* (elimination rate constant is expressed by the constant of elimination K_e) by which the active substance is removed from plasma.
I know these:

- C_0 - initial concentration of drug in site of administration;
- the initial timing determined by $C_1(0)= C_0$ and $C_2(0)= 0$;
- K_a - constant of absorption;
- K_e - constant of elimination.

It requires determination functions/models C_1, C_2 $:[0,\infty) \to R$; t-time, $C_1(t)$, $C_2(t)$ represents the time evolution of concentration of the active substance.

3. Methods and solve

To determine these models/functions will lead to solving a *system of differential equations*. To solve the system of differential equations will be used *Laplace transform* (linear operator). Next we highlight the properties and role of Laplace transform [5].
Applications of *Laplace transform* (linear operator) is used in:

- *Mathematics* - Probability theory, differential equations and systems and calculus (transform derivation operations in algebraic operations);
- *Physical* - optics, harmonic oscillators, optics, mechanical systems;
- *Electrical engineering* - automation, electrical circuits, signal processing;
- *Systems theory* - evolution and behavior of systems, simulation models.

DEFINITION. A function is $f:[0,\infty) \to R$ called if the original function is differentiable and property:

$$\exists M > 0 \text{ and } K \geq 0, \text{such as } \left| f(t) \right| < M\ e^{kt}, \forall t \in [0,\infty)$$

(k = growth index of function f).

Example.

$$f:[0,\infty) \to R,\ f(t) = c_0\left(e^{-0.3\ t}\right).$$

DEFINITION. *Laplace transform* of original function $f:[0,\infty) \to R$ is a linear operator define function

$$£[f(t)] = \int_0^\infty f(t)e^{-pt}dt,$$

and notes $L_f(p) = \int_0^\infty f(t)e^{-pt}dt$, $L_f : R \to R$, i.e. L_f = £[$f(t)$] called *function image* .

THEOREM 1 (*Laplace*). If considered original functions $f, g:[0,\infty) \to R$, then place the following properties of Laplace transform:

1. £[$f(t) \pm g(t)$] = £[$f(t)$] $\pm$ £[$g(t)$] (theorem of linear transform);
2. £[$f(at)$](p) = $\frac{1}{a}$ £[$f(t)$] $(\frac{p}{a})$ (theorem of scalar);
3. £[$e^{at}f(t)$]$(p) = L_f\,(p-a)$ (theorem of translate);
4. £[$f'(x)$]$(p) = pL_f\,(p) - f(0)$ (theorem of derivative I);
5. £[$f''(x)$]$(p) = p^2\, L_f\,(p) - p\, f(0) - f''(0)$ (theorem of derivative II);
6. £[e^{at}](p) = $\frac{1}{p-a}$;

7. £$[e^{-at}](p) = \frac{1}{p+a}$.

Example. If $f(t) = e^{\lambda t}$ is a original function, then the corresponding Laplace transform (function image f) is

$$£[f(t)] = \int_0^\infty f(t)\, e^{-pt} dt = L_f(p) =$$

$$= \int_0^\infty e^{\lambda t} \cdot e^{-pt} dt = \int_0^\infty e^{-(p-\lambda)t} dt = \left[-\frac{1}{p-\lambda} e^{-pt} \right] \Bigg|_0^\infty = \frac{1}{p-\lambda} \quad \Rightarrow$$

$$L_f(p) = \int_0^\infty f(t) e^{-pt} dt = \frac{1}{p-\lambda}.$$

THEOREM 2 (*One-Compartment*). For a one-compartment model which is studying a drug administered extra vascular there an absorption process (function variation $C_1(t)$, active substance concentration) and a process of elimination (variation function $C_2(t)$, active substance concentration).

If you know:

- C_0 - initial concentration of drug in site of administration;
- the initial timing determined by $C_1(0) = C_0$ and $C_2(0) = 0$;
- K_a - constant of absorption;
- K_e - constant of elimination.

at the site of administration for active substance, function variation $C_1(t)$ in the *absorption process* is

$$C_1(t) = c_0\left(e^{-k_a t}\right),$$

and in blood function variation $C_2(t)$ in the *elimination process* is

$$C_2(t) = \frac{k_a c_0}{k_e - k_a}\left(e^{-k_a t} - e^{-k_e t}\right)$$

PROOF. For the convenience of writing we do following notation:

$$f(t) = C_1(t) \ , g(t) = C_2(t).$$

In the area of pharmacokinetics, according axioms linear pharmacokinetics, the amount/concentration of active substance leaving the compartment is proportional to the amount/concentration existing in the compartment.

Therefore, evolution/changes in concentrations over time can be described by the following system of differential equations:

$$\begin{cases} f'(t) = -k_a f(t) \\ g'(t) = k_a f(t) - k_e g(t) \end{cases} \qquad (1)$$

This system will be resolved by applying the Laplace transform method.

If we consider the properties of Theorem 1, we use the following properties (see 1,4 and 7):

- £[$f'(x)$]$(p) = pL_f(p) - f(0)$ (theorem of derivative I);
- £[$f(t) \pm g(t)$] = £[$f(t)$] $\pm$ £[$g(t)$] (theorem of linear transform);
- £[e^{-at}]$(p) = \dfrac{1}{p+a}$.

By applying Laplace transform equation system (1) we get:

$$\begin{cases} pL_f - C_0 = -k_a L_f \\ pL_g = k_a L_f - k_e L_g \end{cases} \Rightarrow \begin{cases} (p+k_a)L_f = C_0 \\ -k_a L_f + (p+k_e)L_g = 0 \end{cases} \quad (2)$$

system with two equations and two unknowns (f and g, functions images) L_f and L_g. Therefore must determine unknowns L_f and L_g.

a) Determination of unknown L_f

The first equation is determined $L_f = \dfrac{C_0}{p+k_a}$ and according to the property 7 from Theorem 6 Laplace transform what does this expression is the function $f(t) = c_0\left(e^{-k_a t}\right)$.
Therefore, in the absorption process the function of variation is

$$\boxed{C_1(t) = c_0\left(e^{-k_a t}\right)}$$

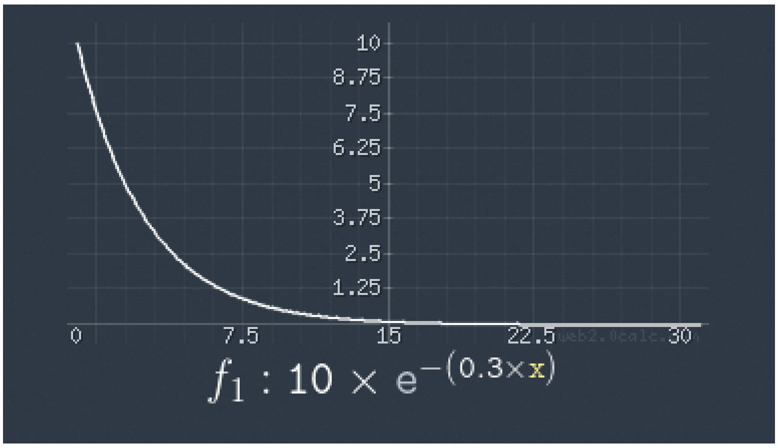

Fig. 5 Use scientific caculator http://web2.0calc.com/ ; plot((10*(EXP(-0.3*x)),x=0..30)

In the absorption process function of variation $C_1(t)$ is the next evolution for the particular case shown above:

- $C_0 = 10$ (initial concentration);
- $k_a = 0.3$ (absorption rate constant).

The variation function $C_1(t)$ is an evolution from a maximum value (initial) with a concentration (C_0 = 10), at the values decrease exponentially towards 0..

b) Determination of unknown L_g

For solving will use Cramer's rule:

$$L_g = \frac{\begin{vmatrix} p+k_a & C_0 \\ -k_a & 0 \end{vmatrix}}{\begin{vmatrix} p+k_a & 0 \\ -k_a & p+k_e \end{vmatrix}} = \frac{k_a C_0}{(p+k_a)(p+k_e)} =$$

$$= k_a C_0 \left(\frac{A}{p+k_a} + \frac{B}{p+k_e}\right) = \frac{k_a C_0}{k_e - k_a}\left(\frac{1}{p+k_a} - \frac{1}{p+k_e}\right).$$

Given the property $£[e^{-at}](p) = \frac{1}{p+a}$, in the process of elimination is deducted as a function of variation $C_2(t)$ is

$$\boxed{C_2(t) = \frac{k_a c_0}{k_e - k_a}\left(e^{-k_a t} - e^{-k_e t}\right)}.$$

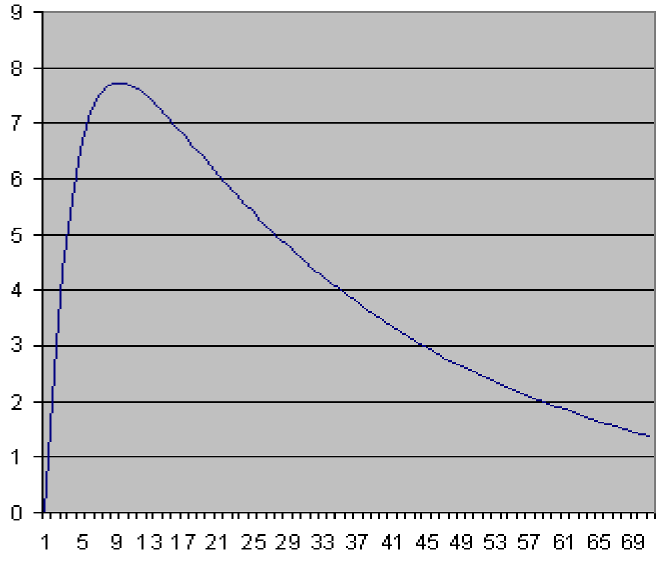

Fig. 6 Function/Curve $C_2(t)$: Use software: Excel

In the Pharmacokinetics of this curve is called absorption-elimination curve.

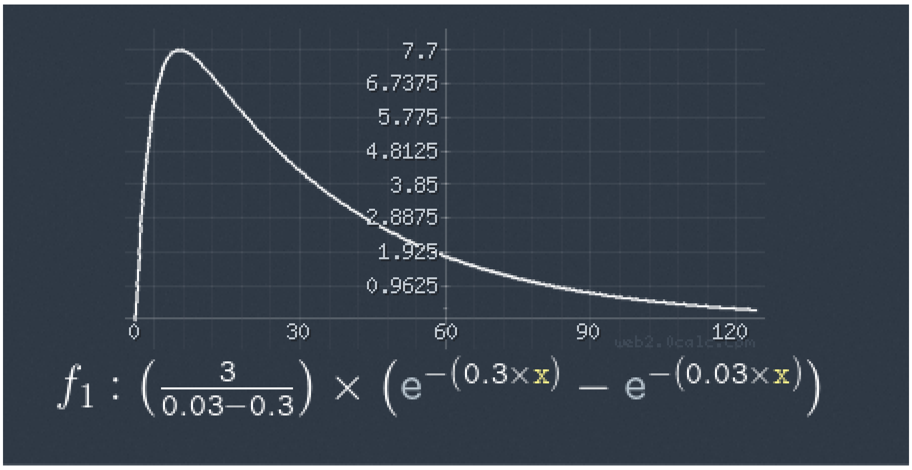

Fig. 7 Use scientific caculator: http://web2.0calc.com/ plot((3/(0.03-0.3))*(EXP(-0.3*x)-EXP(-0.03*x)),x=0..120)

4 Major Results

APPLICATION (residuals method - determination of K_a and K_e). If it is considered an orally administered drug that initially made an initial concentration in the gut $C_0=10$ μg/ml.
Working hypothesis: $k_a > k_e$ for t (time variable) large enough. Based on measurements given in the table are required values (parameters) constants k_a and k_e that determine the model/evolution of variation concentration of the active substance in blood. Assuming one-compartment model, according to Theorem 2, the concentration in the blood is on active substance concentration variation in time expressed by the expression:

$$C(t)=\frac{k_a c_0}{k_a-k_e}\left(e^{-k_e t}-e^{-k_a t}\right).$$

Suppose we are given measurements (observations) that appear in the following table:

T[min]	C(t) [μg/ml]
1	2.551415
3	5.63735
7	7.645865
16	6.783929
30	4.516069
57	2.00962
83	0.921222
85	0.867574
93	0.682458

Table 1. Observation for t and $C(t)$

a) Determination of k_e

It determines the time in which the maximum concentration (maximum of function) to apply linear model for "tail" curve of concentration, so to *Ln C(t)*.

t	ln C
16	1.914556
30	1.507642
57	0.697945
83	-0.08205
85	-0.14205
93	-0.38205

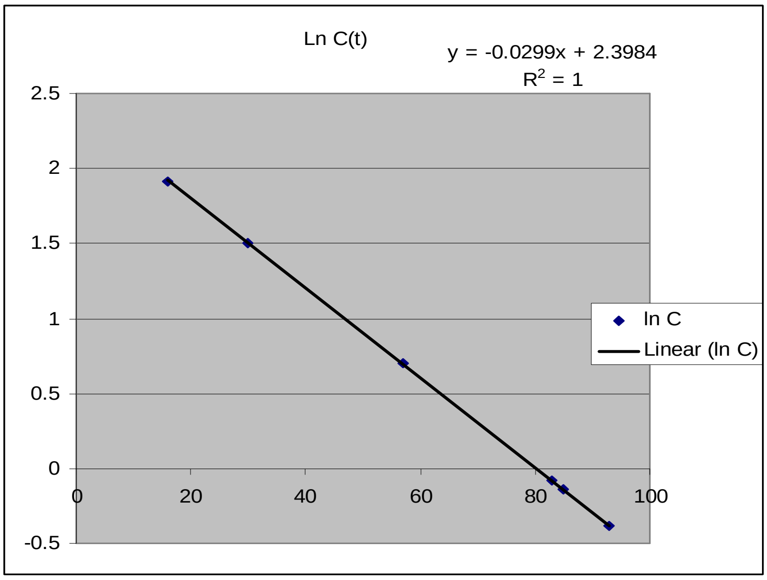

Fig. 8 Graph of function *Ln C(t)*.

Plotted function *Ln C(t)*. Value k_e is slope of line. The regression for values in the table above were determined using Excel program. The result is ***y= -0.0299x + 2.3984***, coefficient of determination $\boldsymbol{R^2 = 1}$. Seeking slope value found is the elimination constant k_e, ie we k_e = **0.0299.**

b) Determination of k_a

According to the working hypothesis, namely $k_a > k_e$, for t (variable time) large enough, is approximating

$$C_1(t) = \frac{k_a c_0}{k_a - k_e}\left(e^{-k_a t}\right) = A\left(e^{-k_a t}\right), \text{ where } A = \frac{k_a c_0}{k_a - k_e}.$$

The logarithms of C_1 is obtained $\ln C_1(t) = \ln A - k_a t$. Plotted function *lnC1(t)*. Value k_e is slope of line.

It is assumed that observations are given in the early part of the time to maximal concentration. Logarithms is to apply linear model used in Excel.

t	1	3	7
C_1	0.823131	0.451744	0.136063
$\ln C_1$	- 0.19464	- 0.79464	- 1.99464

Table 2. Values for C_1 and logarithms

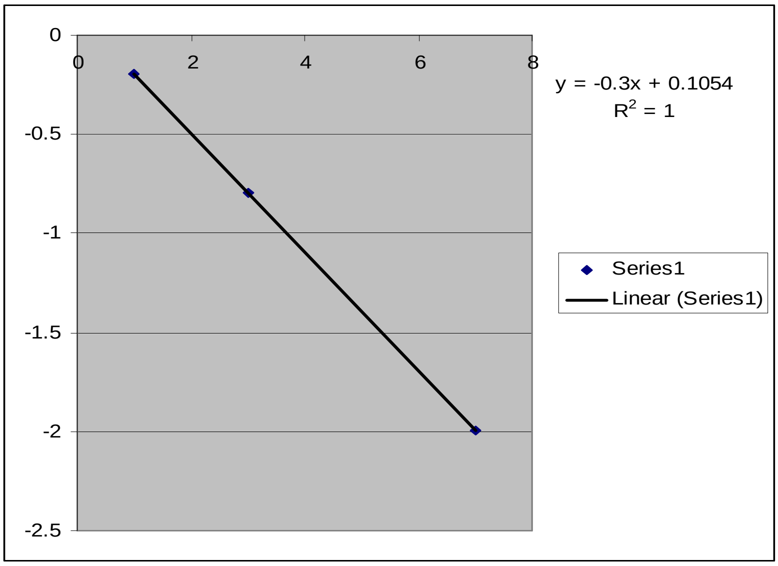

Fig. 9 Graph of function $LnC_1(t)$.

Plotted function $Ln\ C_1(t)$. Value k_a is slope of line. The regression for values in the table above were determined using Excel program. The result is ***y= -0.3x + 0.1054***, coefficient of determination $\boldsymbol{R^2 = 1}$. Seeking slope value found is the elimination constant k_a, ie we k_a = **0.3.**

Conclusions. For a one-compartment model which is studying a drug administered extra vascular there an absorption process (function variation $C_1(t)$, active substance concentration) and a process of elimination (variation function $C_2(t)$, active substance concentration). To determine these models/functions will lead to solving a system of differential equations. To solve the system of differential equations will be used Laplace transform.

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A case study of modeling the object oriented programming knowledge as an educational ontology

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Abstract

Educational ontologies represent important resources for intelligent tutoring systems, e-learning systems and web-based education in universities. They can be developed by modeling the knowledge domain of each university course for all didactical activities: teaching, learning and examination. The paper presents a case study of modeling the object oriented programming knowledge as an ontology by following methodological guidelines of the EduOntoFrame framework. The resulted educational ontology, CS-OOP-Onto, was implemented in Protégé, a Java-based ontology editor. Basic concepts as well as advanced concepts of object oriented programming were included in CS-OOP-Onto, facilitating teaching and learning the Object Oriented Programming course at different levels of knowledge. The modular structure of the ontology allows its extensibility with specific knowledge from different object oriented programming languages such as C++, C# and Java.

Keywords: Educational ontology, Knowledge modeling, University course, Object oriented programming

1 Introduction

Intelligent tutoring systems as well as e-learning systems and web-based education in universities make use of various educational resources such as educational ontologies as means for knowledge sharing and interoperability. A university educational ontology represents a conceptualization of a university course. Such an ontology is composed by a vocabulary of terms from the university course, representing the course domain terminology, with terms definitions, and by a set of axioms with rules and constraints regarding the correct use of terms in various contexts. The development of an educational ontology follows either an existing methodology or an ad hoc chosen one. Usually, a collaborative ontology development methodology is applied, based on the cooperation of course domain experts (e.g. teachers) and knowledge (ontology) engineer.

The paper presents a case study on modeling the domain knowledge of the university course *Object Oriented Programming* from the *Computer Science* undergraduate study program as an ontology, by following the general methodological guidelines of the EduOntoFrame framework introduced in (Oprea, 2013) and the specific ones, described in (Oprea, 2015), for collaborative educational ontology development.

The paper is organized as follows. Section 2 presents a brief overview on some ontology development methodologies and frameworks, focusing on those applied to university educational ontologies development. Also, some important issues about modeling a domain knowledge as an ontology are discussed, with a special emphasize on university courses domains. A case study of object oriented programming knowledge modeling as an ontology (namely, CS-OOP-Onto) is described in section 3. The CS-OOP-Onto ontology was implemented in Protégé, a Java-based ontology editor. The final section concludes the paper.

2 Educational Ontology Development

2.1 Methodologies and Frameworks

Several methodologies and frameworks were proposed for ontology development, some of them being applied to educational ontologies development in universities. Examples are given by DILIGENT (Pinto et al., 2004), HCOME (Kotis and Vouros, 2006), UPON (De Nicola et al., 2009), UPON Lite (De Nicola and Missikoff, 2016), NeOn (Suárez-Figueroa et al., 2012), EduOntoFrame (Oprea, 2013; Oprea, 2015). A brief overview on these frameworks and methodologies is presented.

The DILIGENT methodology provides support to domain experts in a distributed setting to engineer and evolve ontologies. A fine-grained methodology approach based on Rhetorical Structure Theory for ontology engineering argumentation is used. Five activities are performed: (1) initial ontology building, (2) local adaptation of the ontology, (3) local ontology analysis, (4) local ontology revision, and (5) local ontology update. Two case studies are presented in (Pinto et al., 2004). One from the Biology domain and one in a Computer Science Department. DILIGENT is a collaborative methodology that was applied to educational ontologies development in universities.

HCOME (Kotis and Vouros, 2006) is a human centered ontology engineering methodology that was developed from a domain-specific perspective and has some features similar to DILIGENT. It can be applied to collaborative development of academic educational ontologies.

UPON (Unified Process for Ontology) is a reference ontology engineering methodology proposed in (De Nicola et al., 2009). It is based on the software engineering unified process and the UML approach, and was applied to large-scale ontology building in domains such as automotive, aerospace and furniture. The UPON Lite methodology (De Nicola and Missikoff, 2016) is the lightweight version of UPON, released in 2016, for rapid ontology engineering, based on semantic technology. It was designed for enterprise ontologies development.

The NeOn methodology, which is detailed in (Suárez-Figueroa et al., 2012), allows collaborative development of ontologies. It uses the NeOn Glossary for Processes and Activities and is based on nine scenarios for ontologies building (a process viewed as the construction of an ontologies network, where different people can manage different resources). The NeOn methodology performs ontology engineering by reuse. Also, it is applied a merging process for the ontological resources. The methodology was applied to educational ontologies development.

EduOntoFrame is a general framework (described in (Oprea, 2013)) designed for the development of educational ontologies in a university. It is applied in all phases of a full university course didactical activity: teaching, learning and examination. Three main ontologies compose the course educational ontology: the course teaching ontology (Teach-Onto), the course learning ontology (Learn-Onto) and the course examination ontology (Exam-Onto). Each of these three ontologies has one or more course dependent ontologies and one course independent ontology. The independent ontologies contain terms corresponding to the didactical activity (e.g. teaching, learning, examination), including terms specific to pedagogical, methodological and psychological knowledge, that are characteristic to a university didactical activity. A collaborative version of EduOntoFrame was introduced in (Oprea, 2015) which makes use of ontology mapping. Our research work reported in this paper applies the methodological guidelines of EduOntoFrame.

2.2 Domain Knowledge Modeling as an Ontology

Modeling the knowledge of a certain expertise domain can be realized by identifying the fundamental (basic) knowledge and more advanced knowledge from that domain, and their corresponding concepts (basic and advanced), and relationships, followed by their inclusion in an ontology. These steps are detailed as follows.

Algorithm 1: *Expertise Domain Knowledge Modeling*

Input: expertise domain knowledge (*exp-DK*)

Output: ontology (*D-Onto*)

Step 1. identify and define the fundamental (basic) knowledge (*B-DK*) from *exp-DK* and their corresponding concepts (*B-DK-Concepts*) and relationships (*B-DK-Rel*);

Step 2. identify and define the more advanced knowledge (*A-DK*) from *exp-DK* and their corresponding concepts (*A-DK-Concepts*) and relationships (*A-DK-Rel*);

Step 3. include *B-DK-Concepts*, *B-DK-Rel*, *A-DK-Concepts* and *A-DK-Rel* in an ontology, *D-Onto* (i.e. in the ontology hierarchical structure – ontology tree);

Step 4. define the set of axioms (*AS*) with rules and constraints corresponding to the correct use of the concepts included in *D-Onto*;

Step 5. return *D-Onto* ontology.

The formal definition of *D-Onto* is given by relation (1).

$$D\text{-}Onto = \{D\text{-}CR^{exp\text{-}DK}, AS\} \quad (1)$$

where, $D\text{-}CR^{exp\text{-}DK}$, given by relation (2), is the set of concepts (basic and advanced) and their corresponding relationships from the expertise knowledge domain *exp-DK*, and *AS* is the axioms set.

$$D\text{-}CR^{exp\text{-}DK} = B\text{-}DK\text{-}Concepts \cup B\text{-}DK\text{-}Rel \cup A\text{-}DK\text{-}Concepts \cup A\text{-}DK\text{-}Rel \quad (2)$$

We have applied the main steps of ***Algorithm 1*** to university course knowledge modeling as an educational ontology. The case study is described in the next section. Examples of relationships between concepts are: *is-a, ako, has, part-of, required-by, belongs-to* etc. The $D\text{-}CR^{exp\text{-}DK}$ set (given by relation (1)) is extended with pedagogical, methodological and psychological terms ($Terms^{PMP}$), specific to university course didactical activities of teaching, learning and examination. In this case, the formal definition of $D\text{-}CR^{exp\text{-}DK}$ (named, $D\text{-}CR^{UnivC\text{-}DK}$) is given by relation (3).

$$D\text{-}CR^{UnivC\text{-}DK} = B\text{-}DK\text{-}Concepts \cup B\text{-}DK\text{-}Rel \cup A\text{-}DK\text{-}Concepts \cup A\text{-}DK\text{-}Rel \cup Terms^{PMP} \quad (3)$$

Figure 1 shows the general block diagram of the expertise domain knowledge modeling as an ontology with our approach, while Figure 2 shows the modular structure of *UnivCD-Onto*, i.e. the *D-Onto* ontology in the case of a university course domain knowledge modeling with EduOntoFrame framework.

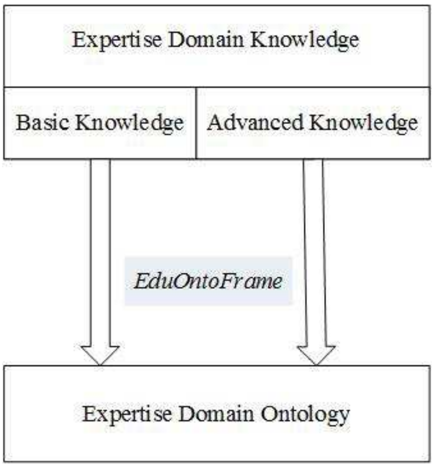

Figure 1. General block diagram of the expertise domain knowledge modeling

The *UnivCD-Onto* ontology contains three ontologies, *Teach-Onto*, corresponding to the university course teaching activity, *Learn-Onto*, corresponding to the university course learning activity and *Exam-Onto*, corresponding to the university course examination activity. According to EduOntoFrame, each ontology is composed by one or more modules (i.e. ontologies) as follows. *Teach-Onto* contains four modules: *CBS-Onto* (course basic subject ontology corresponding to university course basic knowledge modeling), *CAS-Onto* (course advanced subject ontology, corresponding to university course advanced knowledge modeling), *CPS-Onto* (course prerequisite subject ontology corresponding to university prerequisite courses knowledge modeling), and *BT-Onto* (basic teaching ontology). *Learn-Onto* contains two modules: *CPA-Onto* (course practical applications ontology) and *BL-Onto* (basic learning ontology). *Exam-Onto* contains two modules: *CE-Onto* (course examination ontology), and *BE-Onto* (basic examination ontology). One of the main advantages of using EduOntoFrame is given by the modularization of *D-Onto*, that allows its extensibility and easy update.

University Course Ontology (*UnivCD-Onto*)		
Teaching Ontology ***Teach-Onto*** *CBS-Onto, CPS-Onto, CAS-Onto, BT-Onto*	**Learning Ontology** ***Learn-Onto*** *CPA-Onto, BL-Onto*	**Examination Ontology** ***Exam-Onto*** *CE-Onto, BE-Onto*

Figure 2. The modular structure of UnivCD-Onto (i.e. the D-Onto ontology in the case of a university course modeled with EduOntoFrame)

Summarizing, the domain knowledge modeling in the case of a university course is peformed during EduOntoFrame framework application for collaborative educational ontology development. The inclusion of pedagogical, methodological and psychological terms in *D-Onto* is a step specific to EduOntoFrame. Our approach allows the collaboration between knowledge engineer and domain experts (i.e. teachers). Examples of other research work in the area which consider the collaborative educational ontologies development by modeling the course domain knowledge are reported in (Boyce and Pahl, 2007), (Panagiotopoulos et al., 2012) and (Kouneli et al., 2012).

3 Case Study

We have considered for the case study of domain knowledge modeling as an ontology the expertise domain of the university course *Object Oriented Programming (OOP)* from the *Computer Science (CS)* undergraduate study program, that was modeled as the *CS-OOP-Onto* ontology.

Following Algorithm 1 and the EduOntoFrame framework, we have derived the basic and advanced concepts from the OOP domain, as well as their relations. Examples of basic concepts are: *class, object, class member, class interface, class implementation, constructor, destructor, class data, class method, message, abstraction, encapsulation, information hiding, class section, public, private, protected* etc. The basic concepts represent the OOP fundamental knowledge. Examples of advanced concepts are *virtual function, polymorphism, overloading, overriding, inheritance, single inheritance, multiple inheritance, templates, virtual class, abstract class*. Figure 3 shows a part of the basic and advanced concepts hierarchy of OOP. The default relations are *is-a* and *ako*, in the case of concepts taxonomy (e.g. the relation type between **ClassMethod** and **DataMember** with **ClassMember** is *is-a*) and *has, part-of, belongs-to* in the case of ontology component modules (e.g. the relation type between **OOP-BasicConcepts** and **OOP-AdvancedConcepts** with **CS-OOP-OntoRoot** is *part-of*).

The general OOP principles were taken from the OOP textbook (Budd, 1998). The knowledge specific to a certain object oriented programming language (e.g. C++, C#, Java) can be integrated in *CS-OOP-Onto*, by extension.

The implementation of the *CS-OOP-Onto* was done in Protégé 4.3. Figure 4 shows some data properties from the data property hierarchy of the ontology, while some object properties from the object property hierarchy of the ontology are shown in Figure 5. Examples of such entities are *className* (data property) and *hasClassMember* (object property). Figure 6 shows a part of the *CS-OOP-Onto* ontology class hierarchy in Protégé 4.3 with selected basic and advanced concepts.

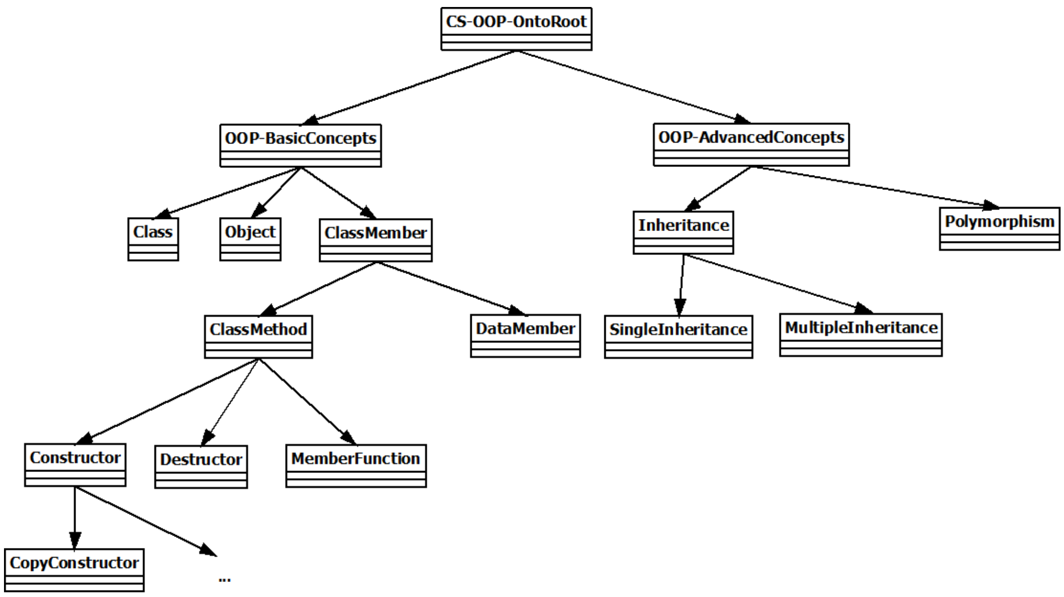

Figure 3. The OOP basic and advanced concepts hierarchy (selection)

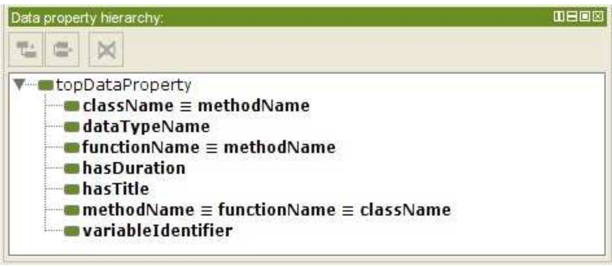

Figure 4. Data property hierarchy for CS-OOP-Onto (selection from Protégé 4.3)

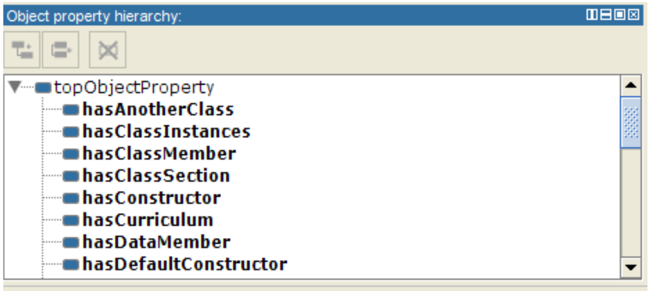

Figure 5. Object property hierarchy for CS-OOP-Onto (selection from Protégé 4.3)

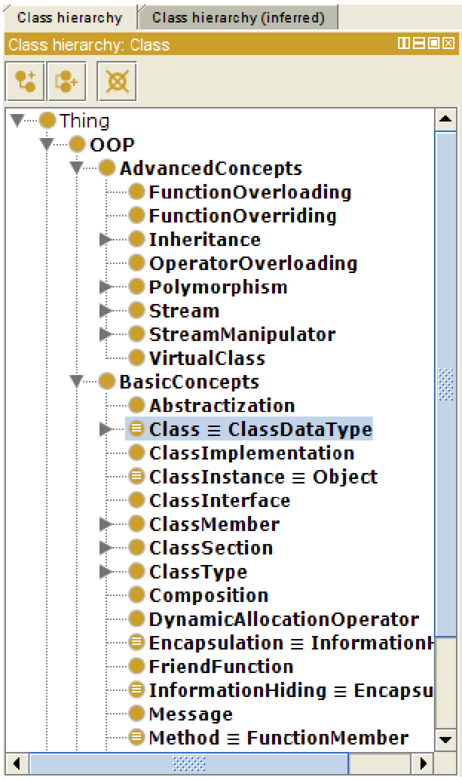

Figure 6. The CS-OOP-Onto class hierarchy (selection from Protégé 4.3)

4 Conclusion

The paper presented a case study of modeling the knowledge from the *Object Oriented Programming* university course as a university educational ontology (*CS-OOP-Onto*) by following the EduOntoFrame framework and Algorithm 1 that was described in section 2. The main benefit of using the developed educational ontology (which models the OOP knowledge) is given by its modular structure which facilitates extensibility and easy update, being a proper educational resource for web-based education, e-learning and intelligent tutoring systems implemented in universities.

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Protégé http://protégé.stanford.edu, accesed 2016

Cultural Landscapes and Geography University Students' Learning on Facebook Discussion Groups

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Abstract

The Facebook socialising network is an environment where university students spend significant time to express their opinions and to share frequently diverse information pieces and spectacular images. Starting from the finding that many geography university students have difficulties in understanding and assessing landscapes for territorial planning, in this research we experimented a learning approach based on using the shared photos on Facebook. In order to do this, we created a closed discussion group and we proposed its members (university students at the M.Sc. programme of Regional Planning and Development at the Faculty of Geography, Babeş-Bolyai University, in Cluj-Napoca) to analyse and interpret a series of cultural landscapes. The aim of this activity was detailed observation for in depth understanding of cultural landscapes. At the end of the experiment, we analysed our students' learning process and the results starting from their answers to our questions.

Keywords: E-learning, Facebook discussion group, Photographs, Cultural landscapes, Territorial planning

1. Introduction

Facebook is part of the Web 2.0. phenomenon (Cerdà and Capdeferro, 2011), being a virtual learning environment, with some features of e-learning platforms. Facebook offers certain learning advantages (i.e. it supports in depth learning and stimulates critical thinking), but it also has certain weaknesses (i.e. limited control over the contents of learning and it does not offer feedback about learning achievements) (Alias et al., 2013; Pappas, 2015; Dulamă et al., 2015a).

Facebook socialising network is used as an informal tool in organising study groups for courses, for ensuring co-operation among those engaged in learning (Ellison et al., 2007; Dulamă et al., 2016a). All geography university students in Cluj, who answered about their use of Facebook declared that they used it with diverse purposes (Dulamă et al., 2015b). Those students formed Facebook discussion groups that functioned as active Geography learning communities where they solved problems, discussed certain topics, organised events, read and watched diverse materials and shared the most interesting ones (Dulamă et al., 2015a, 2015b). The pre-university students in Romania also used discussion groups as an opportunity to learn together, with their teachers' support, in order to be able to assess themselves or to be assessed for the Geography exam during their high school graduation exam (Dulamă et al., 2016a). Both pre-university and university students spend a lot of time on Facebook, frequently sharing their thoughts, diverse information, and spectacular images (Dulamă et al., 2015a, 2016a). For instance, some of the shared photos on Facebook are about landscapes, and some of these, are cultural landscapes. The cultural landscape is considered a reflection of the life style and of a human community's development (Duncan and Duncan, 2004, p. 228; Sârbu, 2011).

Because during our didactic activities we noticed that Geography university students had certain incorrect geographical representations (Dulamă and Ilovan, 2016) and that they had difficulties in analysing and interpreting/understanding natural and cultural landscapes, and these influenced their competence to elaborate proposals of spatial planning measures (Dulamă et al., 2016b), in this research, we experimented a few learning activities in a Facebook closed discussion group. In this group, students attending the M.Sc. programme of *Regional Planning and Development*, at the Faculty of Geography, Babeş-Bolyai University, in Cluj-Napoca, were invited to look at photos with cultural landscapes aiming to an in depth understanding of what appeared in those images. To create optimal co-operation, an informal, and optional learning environment, we made sure we did not intrude in our students' privacy and we appreciated their contribution (Ortega, 2013, p. 1672). At the end of our experimental activity, we analysed the discussion group's activity and results.

2. Material and method

2.1. Participants and Procedure

The experimental activity took place at the end of the 2015-2016 academic year. To collect the data we needed, we created a Facebook discussion group and we named it *Geographical photos*. Using the e-mail, we invited several M.Sc. students (from the educational programme of *Regional Planning and Development* at the Faculty of Geography, Babeş-Bolyai University, in Cluj-Napoca) to enlist in the discussion group. Our aim was to form a 10-member group. This group had 16 members, M.Sc. students in their 1st and 2nd years of study and they got involved into the activity on a voluntary basis. This sample size and features do not represent the total population of M.Sc. students enrolled at the *Regional Planning and Development* educational programme in this faculty. Generalisation of research results is limited because our research included a small number of participants (only a sixth of the students at that M.Sc. programme).

After we created the discussion group, we shared six photos with natural and cultural landscapes from Romania, which had been previously shared on the Facebook socialising network: *The Ponor Meadow*; *Hagieni Natural Reserve; Charlottenburg Settlement; Turda Salt Mine*; *Cluj-Napoca*; *The Toroc Hill*. The task was that each group member asked an analysis question starting from each photo and did not repeat the questions previously asked by the other group members. Because it was an activity outside the official curriculum, we communicated our students that the discussion group lasted for just a few days.

2.2. Data Collecting and Research Material

We analysed our students' involvement in the discussion group and their questions starting from the photos with cultural landscapes. We grouped them according to the communicated tasks and then we categorised them.

3. Results and discussion

3.1 Analysis of roles and activities in the discussion group

Analysis of roles in the discussion group. The professor had responsibilities related to organizing the group (creating the discussion group, inviting M.Sc. students to enrol in the group), to designing teaching activities (searching for and selecting photos, formulating tasks and requirements), and to organizing the learning process (photo sharing, communication tasks and requirements, the proposed learning method, dosing time, giving feedback). The professor monitored each member's work, reviewed the group's activity and results. M.Sc. students had roles in discussions and as observers.

Review of members' work in the discussion group. Although the group comprised 16 members, 12 students (85%) read the task, five pictures were viewed by 12 students (85%) and one by 13 of them. Starting from photos, students asked 48 questions during three days: 14 questions (29%) on the first day, 19 questions (39%) on the second day, and 15 questions (30%) on the third day. Starting from each photo, students asked a certain number of questions: 5 questions for one photo, 8 questions for two photos, and 9 questions for three photos. On average, a student asked 5.33 questions out of the 6 questions the professor required for.

3.2. Analysis of the photos that the professor shared

Regarding the photos shared on Facebook, because they were taken from various sources, we were faced with the problem of identifying their author and copyright. We chose six cultural landscapes, with varying degrees of human intervention: very low (Hagieni Natural Reserve, Fundatura Ponor), medium (the Toroc Hill), big (Charlottenburg settlement), and very big (Turda Salt Mine and Cluj-Napoca). These landscapes are formed on different major landforms (mountains, hills, plateau), have varied micro-relief (meadows, depression, slope, interfluves), and also underground (the salt mine).

Each landscape has high complexity and variety, consisting of many natural and anthropogenic components, which offer the possibility of asking many questions and generate discussions about their territorial arrangement, with different aims. We chose those photos due to their landscape composition (Hagieni), uniqueness of their structure (Charlottenburg), spectacular setting (the salt mine), adaptation of the urban landscape to the river topography (Cluj-Napoca), and malfunctioned man-nature relationship (the Toroc Hill).

The Ponor Meadow (Figure 1) is located near the village of Ponor, in the Şureanu Mountains of the Southern Carpathians. The small depression drained by the river Ponor is called "the God's Hand" due to its beauty. The place is part of the Grădiştea Muncelului-Cioclovina National Park in the Şureanu, the Parâng and the Lotru Mountains (http://www.voceatransilvaniei.ro/931215-2/). We chose this photo because of the small incline of the micro-depression, where the river has a meandered course.

Hagieni Natural Reserve (Figure 2) lies at 15 km from Mangalia, near the lake of the same name. On its 400 hectares, there are over 800 species of protected plants and animals (http://www.mangalianews.ro/2015/05/stiati-asta-se-intampla-pe-litoral-la-15-kilometri-de-mangalia-si-este-cu-adevarat-o-minune-video/).

Figure 1. The Ponor Meadow
(http://www.voceatransilvaniei.ro/931215-2/)

Figure 2. Hagieni Natural Reserve
(http://www.mangalianews.ro/2015/05/stiati-asta-se-intampla-pe-litoral-la-15-kilometri-de-mangalia-si-este-cu-adevarat-o-minune-video/; https://peterlengyel.wordpress.com/2011/10/14/padurea-hagieni-dobrogea/)

Charlottenburg (Settlement) (Figure 3) is a village with 124 inhabitants, in Timiş County. In 1771, during the second wave of German colonization, when Empress Maria Theresa of Austria ruled the Habsburg Empire, it was set up with 32 families (131 persons) of Germanic origin. Carl Samuel Neumann Edler von Buchholt, an official at the Office of Salt in Lipova, coordinated the arrangement of the village in a circular plan, with an inner diameter of 210 metres. Being the only village with a circular shape in the entire region of Banat, Charlottenburg was declared a historic monument by the Ministry of Culture. Nowadays, most of its population is Romanian (http://www.expunere.com/satul-rotund-din-romania-bijuteria-aproape-necunoscuta-ascunsa-intre-dealuri.html).

Turda Salt Mine (Figure 4), in Turda, Cluj County, was spectacularly furbished during a 2008-2010 PHARE programme (worth 6 million lei) (http://salinaturda.eu/; https://www.facebook.com/salinaturda).

Figure 3. Charlottenburg
(http://www.expunere.com/satul-rotund-din-romania-bijuteria-aproape-necunoscuta-ascunsa-intre-dealuri.html)

Figure 4. Turda Salt Mine
(https://www.facebook.com/tuktukro/photos/a.223272167698391.75551.185080094850932/1270005186358412/?type=3&theater)

Cluj-Napoca (Figure 5), the second largest city in Romania, capital city of Cluj County, is crossed by the rivers Someşul Mic and Nadăş. On the Toroc Hill, in the town of Dej (Figure 6), there is the Toroc Spa Park. The landslide occurred after overloading the slope with demolition materials (http://www.dejeanul.ro/content/dealul-torocului-luat-o-la-vale-sunt-sau-nu-pericol-casele-din-zona-fi).

Figure 5. Cluj-Napoca
(https://www.facebook.com/Respect-Clujul-485517011507653/photos)

Figure 6. The Toroc Hill
(http://www.dejeanul.ro/content/dealul-torocului-luat-o-la-vale-sunt-sau-nu-pericol-casele-din-zona-)

3.3. Analysis of students' questions

According to Table 1, students asked 48 questions, out of which 6 were analysis questions, 25 were interpretation questions, and 17 were questions that could not be answered only by studying those photos. Question analysis focused on landforms, vegetation, and environmental components (What landform is predominant in the photo? What is the characteristic vegetation? What is the common element for all village houses? What building materials were used for furbishing the salt mine? What season was the photo taken?). The small number of analysis questions (6) indicates that students paid attention to small landscape visible aspects, considering them obvious and clear and not requiring asking questions to ensure their understanding.

Starting from the name of the place (Fundatura Ponor), a student asked a question for the clarification of the concept (What is a sinkhole?). Considering that "Ponorul" (sinkhole) is a landform in karst regions (pit, sinkhole, depression), through which surface waters are leaking underground (DEX, 2009) and observing the river in the photo, other questions appeared: Where exactly is the water flowing underground? Are there dangerous places in these micro-depressions because water flows underground?

The many interpretation questions (25) indicate curiosity and concern for understanding the causes, factors and conditions that caused the natural or anthropic phenomena and processes visible in the respective landscapes (What factors helped define the circular shape of the Charlottenburg village? Why was wood chosen as the main material for arranging the salt mine? How is salt affecting metal and wood constructions? Why was the salt mine restored as a touristic objective?). The questions indicate concern for identifying the relationships among environmental components (How has the presence of the natural axis – the Someşul Mic – favoured the development of Cluj-Napoca?), malfunctions (What urban irregularities can one identify in Cluj-Napoca city?), restrictive elements (What restrictive element appears when placing houses in a circular shape?), and advantages and disadvantages (What are the advantages and disadvantages of villages with round shape structure?).

Some questions aimed at identifying consequences of human intervention on the environment that were already visible (What were the main consequences of the construction of the new city stadium?) or possible (How would the built area affect the expansion of the ravine detachment slip?). Other questions indicate prospective thinking (What are the causes that may lead to the onset of new landslides on the Toroc Hill? What types of tourism can be practiced in Fundatura Ponor?), and concern for taking measures to solve dysfunctions and mitigate risks (What measures should be taken to remedy this land from the Toroc Hill?). One question indicated interest in landscape identity (Which element highlights the best landscape authenticity of Fundătura Ponor?).

Each question indicated a certain understanding of the territory. The landscape from Hagieni Reserve was associated with a river, a marsh (Does the convulsion of the watercourse enhance the marsh?), and riverbank erosion (On which part of the bank is the erosion more intense?). About Lake Hagieni, new questions may arise: What are the clues to support that it is a lake? What does the presence of reed on the water shore indicate? What does the irregular shape of the riverbank indicate?

Table 1. Number of Analysis and Interpretation Questions

Place name (cultural landscape)	Questions			
	Total number	Analysis	Interpretation	Other questions
The Ponor Meadow	9	2	3	4
Hagieni Natural Reserve	8	1	3	4
Charlottenburg	9	1	5	3
Turda Salt Mine	9	1	4	4

Cluj-Napoca	8	1	6	1
The Toroc Hill	5	0	4	1
Total	48	6	25	17

In Table 2, we see that students asked 5 questions about the location, name and history of the places, which could not be answered by looking at the landscape in the photo. 8 questions related to natural components, 11 questions were about anthropogenic components, 5 questions were about environmental protection, related to landscape and risks, and 17 questions related to spatial planning. Questions showed students' interest in spatial and human components and less concern for natural components.

Table 2. The Contents Students' Questions Focused on

Categories of components	Name of the component	The Ponor Meadow	Hagieni Natural Reserve	Charlottenburg	Turda Salt Mine	Cluj-Napoca	The Toroc Hill	Total
Name			1		1			2
History					1			1
Location		1		1				2
Natural components	Landform	2	2				1	5
	Water	1						1
	Weather/ Climate					1		1
	Bio-soil-geographical component		1					1
Anthropogenic components	Population	1		2		1	1	5
	Human settlement			1				1
	Agriculture	1						1
	Tourism	1		1	2			4
Environmental protection		1	4					5
Landscape		1						1
Risks							1	1
Territorial planning				4	5	6	2	17

4. Conclusions

After analysing the e-learning activities that our M.Sc. students, from the *Regional Planning and Development* educational programme, performed within the Facebook discussion group named *Geographical photos*, we reached the following conclusions:

We noticed that there were several advantages in performing the learning activities: learning was possible even if some members were passive observers and readers; all members could benefit of the materials shared within the group (texts, photos, maps, charts, etc.); they could ask questions, answer questions, write their opinions; any student could clarify within the group certain issues or the approached topics.

We identified also several disadvantages: because each post was transmitted to all group members, the e-mail was overcrowded with Facebook messages; one could be included in a discussion group irrespective of one's wish to be a part of that group or not; one was exposed to other members' critical thinking when writing opinions, questions, answers, and comments, because thus appeared certain lacunae, mistakes, confusions, misunderstandings; not always the shared information/materials were correct. Because this was an activity outside their curriculum, the M.Sc. students were careful about getting involved into the activity, especially because not all of them knew each other. In addition, for the professors was difficult to identify on Facebook the photos that were appropriate to their research and learning objectives, that was, in this case, the cultural landscapes with a certain complexity level.

Taking into account the question production, our appeal that students asked one question starting from each photo, although it aimed at creating all conditions that every student got involved, was also a restrictive factor. To develop our students' capacity to systematically observe and analysed cultural landscapes, during future research, also students' behaviour could be analysed in the specific situation when they are asked to phrase as many questions as possible starting from one photo. In order to enable in depth learning and to stimulate critical thinking, professors may ask questions starting from the shared photos and encourage group members to answer.

Further research could also focus on analysing the answers to the questions asked in the discussion group and professors control the contents of learning and give feedback about students' learning achievement.

Finally, we conclude that Facebook discussion groups are an environment that ensures the optimal conditions for e-learning in geographical university education.

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Using GIS in Initial Professional Training for Territorial Planning during Geography University Studies

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Abstract

GIS (Geographic Information System) is defined as a system used in order to capture, store, manipulate, analyse, and process spatial or geographical data through computerised processes. The use of GIS has a positive impact in the field of territorial planning. The aim of our research was to analyse the way in which geography university students at the M.Sc. programme of Regional Planning and Development used GIS for their professional training. To achieve this aim, we administered a questionnaire to the students that graduated this M.Sc. programme in 2016 and to those who graduated only the first year of this programme, at the Faculty of Geography, Babeş-Bolyai University, in Cluj-Napoca. We wanted to learn at what courses those students used GIS both at the Bachelor's and M.Sc. level, what kind of maps necessary for territorial planning they could realize using GIS, which were the difficulties they had to cope with when forming their competence to use the GIS software, and which were the advantages they had when using GIS for realising diverse research projects.

Keywords: GIS, Territorial planning, Geography higher education, Questionnaire survey.

1. Introduction and Theoretical Approach

The state of geospatial education research was investigated by those interested in geospatial technologies (digital maps, GIS, GPS, remote sensing, digital globes, etc.) and they concluded that "geospatial technology has the potential to contribute to learning outcomes across disciplines" (Baker and Langran, 2015, p. 1). For Geography in general and for territorial planning in particular, the extant GIS modeling instruments are both necessary and sufficient (Sheina et al., 2010), although there is place for improvement, as presented by new approaches (for instance, the development of "Bottom-Up GIS" – BUGIS – which focuses on the use of GIS in participatory planning activities, for planners to incorporate local knowledge, being "an effective tool to deepen our understanding of residents' perceptions of local issues and preferences") (Talen, 2000, p. 279). Moreover, due to continuous changes in geospatial technology, web-based systems and open-source geospatial software provide new opportunities and challenges, which the educational staff, students, and territorial planners should grasp more aggressively (Drummond and French, 2008).

These opportunities and challenges of learning and using GIS were researched. Recent literature in the field proves that geographic information system (GIS) education promotes and develops students' spatial thinking (Jo et al., 2016), especially if started at the pre-university level (for instance, for high school students' environmental education through creating GIS story maps) (Brigham, 2016).

Therefore, as an instructional tool, GIS has been approached with interest by academia, from different perspectives. First, to make GIS an active learning tool for teaching undergraduate Geography students (Peirce, 2016; Yin, 2010). Secondly, tertiary GIS education proved helpful for diversifying graduating students' opportunities either on the job market or their employability in scientific research (Marr et al., 1998), and particularly for Geography graduates (Șeremet and Chalkley, 2016). Thirdly, due to the significant role of GIS in understanding Geography, efforts have been made to enlist free and open source GIS software tools and present their use for education in low resource settings (Nawaz and Sattar, 2016).

In this context, the aim of our research was to analyse the way in which geography university students used GIS for their professional training at the M.Sc. programme of *Regional Planning and Development*, at the Faculty of Geography, Babeș-Bolyai University, in Cluj-Napoca, Romania.

2. Material and method

2.1. Participants

The research we realised at the end of the 2015-2016 academic year focused on analysing 21 students' opinions (the sample included students who graduated the 1st and 2nd year of at the M.Sc. educational programme of *Regional Planning and Development* at the Faculty of Geography, "Babeș-Bolyai" University in Cluj-Napoca, Romania). 52.4% of the respondents graduated the 1st year and 47.6% the 2nd year. The total number of students in the 1st year was 32, and in the 2nd year there were 34 students. Therefore, only about one third of those students agreed to be our respondents. Thus, the sample size may influence research results and data generalisation.

2.2. Procedure, Data Collecting and Research Material

We collected the data using a questionnaire survey that we realised by using the Google Forms application in Google Drive. We sent the invitation to complete it to all students (66) who formed our target group. 21 students filled in the questionnaire on-line and on a voluntary basis. The questionnaire had 15 items about: when they first learnt to use GIS and about the courses they actually used it to realise maps during Bachelor's and M.Sc.'s study educational programmes; the types of thematic maps they realised; the advantages of GIS for territorial planning; the difficulties of using GIS; students' use of tutorials to learn GIS and their importance for training; the importance of the practical activities in the faculty labs for learning GIS. The answers to these items were our research material.

3. Results and Discussions

At the question *whether they knew how to use GIS*, out of the 21 respondents, 81% answered that they did. Related to their initiation in GIS, 83.3% answered that it took place in their first year of study at the Bachelor's level, at the Faculty of Geography. Only 3 respondents (16.7%) said that they were initiated in their second year of study and it is possible that those students graduated the Faculty of Geography some years ago (when GIS was not so much present in the curriculum).

The most frequent use of the GIS was characteristic of their first year at the Bachelor's level according to 83.3% of the respondents. GIS use decreased during the 2nd year (according to 72.2% of the respondents) and in the 3rd year (66.7%). 66.7% of them said that they used GIS during their M.Sc. studies, in their first year, and 44.4% answered the same for their 2nd year. Therefore, we underline that, at this Faculty of Geography, GIS use decreased from the first year at the Bachelor's level to the last one at the M.Sc. level. Still, we also point out that almost half of our respondents were in their 1st year at the M.Sc. level, so it may be that their number influenced the results when they answered that they did not use GIS in the 2nd year.

Respondents' answers also showed that at this Faculty of Geography, professors and students used GIS during very many courses, at both study levels. To have a synthetic perspective on this, we grouped the respective courses according to the three branches of Geography: Physical Geography, Human Geography, and Regional Geography. Due to the fact that most of our respondents had been enrolled at the *Territorial Planning* specialisation during their Bachelor's studies and now they were at the *Regional Planning and Development* M.Sc. educational proogramme, the courses on topics from Regional Geography stood out among the ones where they used GIS. Nevertheless, there were courses focusing on GIS, such as Geoinformatics, GIS applications, Integrated spatial analysis, GPS applications, Introduction to GIS, etc. or courses that partially used those techniques, such as Urban planning, Rural planning, Regional systems, Regional disparities, etc. The Physical Geography branch was on the 2nd place, with such courses using GIS: Hydrology, Risk geographical phenomena and processes, Geomorphology, Digital cartography, Topography, etc. To the Human Geography branch belonged the smallest number of courses using GIS: Geodemography and habitation, Geography of settlements, Geography of population, Economic Geography of the World, and Human Geography of Romania. Therefore, students used GIS during the courses of their specialisation in Regional Geography and planning, but there were also courses of other geographical branches and sub-branches using GIS, focusing on landforms, the hydrographical component, demography, etc.

It is characteristic of Geography to create, analyse, and interpret maps. The GIS knowledge and skills that students achieved during their Bachelor's level enabled them to create on their own the maps they needed, while using the extant data bases and realising a big number of maps requested during almost each course they had. After analysing the respondents' answers about the thematic maps they actually realised by themselves using GIS during their Bachelor's studies, we noticed that, out of all the maps they realised, the most numerous ones fell in the following categories: geomorphological (16 maps); hydrological (14 maps); population, settlements, and transport maps (13 maps for each category); bio-geographical maps, maps of agricultural activities and tourist maps (10 maps for each category). Beside these, students also realised below 10 maps of the following categories: soil maps, meteorological maps, maps of industry, complex geographical maps, administrative maps, maps of cultural activities and cultural products, maps of health services, maps of sports activities, and environmental maps.

Within the above mentioned categories of maps, we asked students to point out the maps they realised during their Bachelor's studies. They realised geomorphological maps (e.g. elevation maps, slope exposure maps, slope maps, etc.), soil maps (e.g. the map of soil types), environmental maps (e.g. maps of natural reserves/parks, maps of flood risk areas, etc.), population maps (e.g. maps of the population's gender structure, maps of the population's age structure, population density maps, ethnic structure maps, etc.), settlements maps (e.g. maps of settlements' distribution, maps of settlements types according to the inhabitants' number, etc.). In fact, respondents' answers showed that they (as a group) realised at least one map for each map category.

Using GIS for realising maps continued during the M.Sc. studies of *Regional Planning and Development.* Students realised maps in all categories, but mainly territorial planning and arrangement ones. Our respondents realised most frequently the following ones: human settlements maps (16), geomorphological maps, hydrological maps, and transport maps (13 of these from each category), population maps (11). Other categories of maps included below ten maps realised by our respondents, the smallest number belonging to meteorological maps, political maps, and to sports activities maps.

The most frequent maps were the following: land use maps, functional areas maps, railway transport maps, car transport maps, urban transport maps, inter-urban transport maps, health units maps, strategic proposals maps, etc. In fact, during their M.Sc. studies, we noticed a focus of GIS maps on the field of territorial planning and arrangement and of spatial development strategies.

There were two types of respondents' answers to the question about *the advantages of GIS use for territorial planning*: (1) on a Likert scale, they had to choose values (from 1 to 5) for the advantages that we presented (we identified 9 advantages) and (2) they had to list other advantages of GIS use in realising maps for territorial planning.

The advantage that *using GIS is more objective* received the highest average score (Figure 1). Most of the respondents considered that GIS maps were more objective in comparison to the ones realised in the classical manner, both in what expressing the contents and representing reality were concerned.

With the assertion that *GIS reduces and makes easier the classical work of realising maps*, 14 respondents agreed completely. Two of the respondents considered that GIS was no easier way to realising maps and gave this advantage the minimum score.

Overlapping many thematic strata was considered a significant advantage and 12 respondents assigned it the maximum score and only one the minimum. Respondents considered realistically that a GIS map enables the overlapping of several thematic strata and free selection, being able to place the most important one in the foreground.

The quick possibility to realise intra- and inter-regional correlations was a feature of the resulted maps that respondents assigned an average score above 4. That meant that GIS maps enabled identifying extant intra- and inter-regional correlations, and nine respondents assigned this advantage the maximum score.

The actual situation of territorial development rendered on a GIS territorial planning map had an average score above 4, meaning that such maps reveal closely the territorial reality. Therefore, four respondents assigned this advantage a score of 4, while six of them chose the maximum score. Just one respondent considered this feature of GIS maps as irrelevant.

Respondents underlined that using GIS to realise maps characteristic of territorial planning enabled them to identify more easily *the distribution of geographical elements on a territory*. Only two respondents did not recognise that advantage of GIS maps (assigning it the minimum score), while ten respondents chose the maximum score.

According to our respondents, GIS maps enabled *in depth understanding of territorial relations*. Two respondents chose the minimum score, while six of them opted for the maximum one.

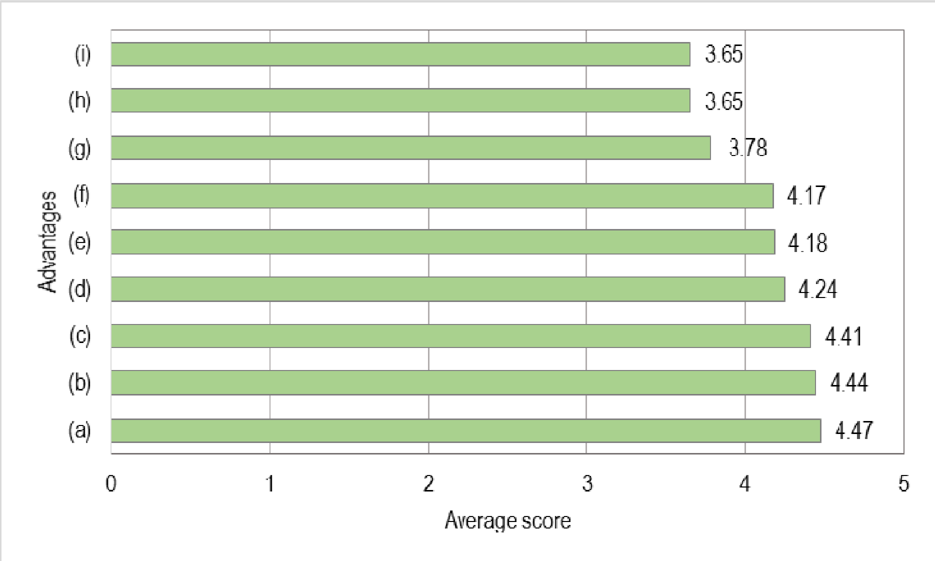

Figure 1. Respondents' Assessment of GIS Use Advantages for Territorial Planning
(a) It is more objective; (b) It reduces and makes easier the classical work of realising maps; (c) It enables the overlapping of many thematic strata; (d) It offers a quick possibility to realise intra- and inter-regional correlations; (e) It presents the actual situation of territorial development; (f) It presents the distribution of geographical elements on a territory; (g) It enables in depth understanding of territorial relations; (h) It enables identifying the features of territorial components; (i) It enables precise representations of the geographical reality.

Identifying the features of territorial components on a GIS map received the average score of 3.65, being quite possible rather than hard to realise. Four respondents assigned it the maximum score, while only one respondent considered this not to be an advantage.

Answers pointed out that GIS maps are *precise representations of the geographical reality*, the average score of 3.65 supporting this statement. Seven respondents chose the score of 4, while other four opted for the maximum score. On the other hand, two respondents considered that such maps were not precise representations of the geographical reality.

Asked to mention *other advantages of GIS use in territorial planning*, respondents answered that GIS had a significant role in the field of territorial planning also for other reasons than realising maps. Also because of the other cartographical products (e.g. choremes, sketches, charts, etc.) it offered, GIS enabled easier analyses due to the following: easier identifying of dysfunctions and of realising territorial development proposals; enabling detailed territorial analyses; one could use this software anywhere after installation; it enabled the creation of complex databases; it enabled identifying the elements that led to territorial development; it enabled establishing the suitability of certain pieces of land for diverse technical infrastructures, etc.

To the question about their *difficulties when using GIS,* respondents' answers were also twofold: (1) they assigned scores from 1 to 5 to those difficulties we identified and (2) they identified other difficulties.

Difficulties caused by lack of the latest software and of licenses for using it were the most important ones, receiving the highest average score (3.23, see Figure 2). Nine of our respondents had serious difficulties because of this. Therefore, students used the licensed software within faculty labs because they could not afford buying them for their PCs.

Difficulties caused by access to software only in faculty labs received the next average score (2.47). For six of the respondents, this situation was not a difficulty, but five of the respondents assigned it a score of 4 and one the score of 5, meaning that they used the GIS software mainly in the faculty labs (not affording to work with it at home or somewhere else).

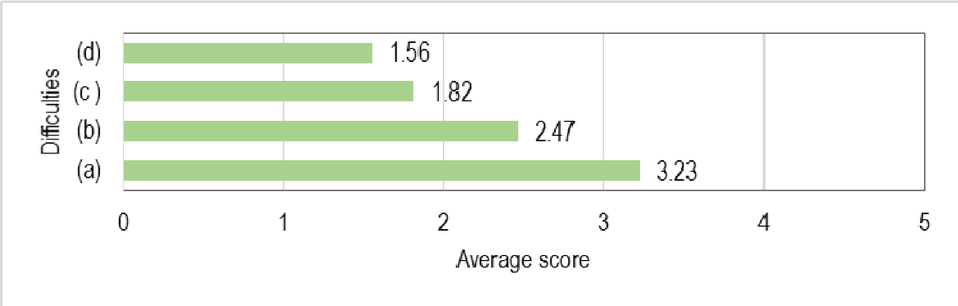

Figure 2. Respondents' Assessment of Their Difficulties Using GIS
(a) Difficulties caused by lack of the latest software and of licenses for using it; (b) Difficulties caused by access to software only in faculty labs; (c) Difficulties caused by students' English level; (d) Difficulties caused by students' lack of good PCs.

Difficulties caused by students' English level were on the third place. Students' answers showed that English GIS software was not a serious difficulty. Only one of our respondents assigned it the maximum score, most of them choosing the minimum one. So we concluded that respondents understood English in general and specialty language characteristic to GIS in particular.

Students had no *difficulties caused by their lack of good PCs*, meaning that their PCs were good enough for the GIS software. They assigned to this difficulty the lowest average score (1.56), with ten of the respondents choosing the minimum value. Only 3 respondents chose the score of 3 and there were no respondents choosing higher scores.

Beside the four difficulties the respondents assigned scores to, they also identified others that they had to cope with when using GIS. Thus, their answers pointed out the following difficulties: frequent software changes (the newest ones were expensive); cumbersome license installing and activating; GIS software was not compatible to all Windows versions; some GIS maps required a lot of time for obtaining the necessary data; not all courses required realising maps; frequent software errors while using GIS; no up to date PCs for a quick analysis of the databases when needed for complex maps; the need to use tutorials in order to understand GIS, etc. We point out that respondents identified diverse types of difficulties: hard to solve technical ones, some caused by students' partial knowledge and skills, and some generated by incomplete infrastructure within faculty labs.

Most of the respondents (83.3%) used tutorials to learn GIS, while only three of them did not need them and succeeded to learn GIS during faculty courses and labs. The conclusion is that the present didactic activities are not enough for learning GIS.

Web tutorials helped respondents significantly to learn GIS, as the average score they assigned to tutorials was 3.31. For nine of them, tutorials were the main learning aid and therefore they assigned scores of 4 and 5. Still, for three of them, tutorials had no importance in their GIS training.

The practical activities during faculty classes, at technical courses that supposed using GIS, were decisive for most respondents' training. Thus, they assigned the average score of 4 to those activities. Six respondents gave the score 5 to faculty activities, while 8 respondents gave them 4.

No respondent assigned the minimum of 1 and that proved that respondents learned GIS to a certain extent during faculty classes.

4. Conclusions

At this Faculty of Geography, professors and students used GIS during very many courses, at both study levels (Bachelor's and M.Sc.'s). The courses on topics from Regional Geography stood out among the ones where they used GIS, because of students' specialisation (in Regional Geography and planning), but there were also courses of other geographical branches and sub-branches using GIS. According to students' answers, during their M.Sc. training, they realised maps of all thematic categories, while the most numerous ones were from the field of territorial planning and arrangement.

Besides realising quality maps, respondents identified other features of GIS that ensured quality analysis in the field of territorial planning and arrangement. The advantage that GIS is more objective received the highest average score, followed by other two significant ones: GIS reduces and makes easier the classical work of realising maps and it enables the overlapping of many thematic strata.

We point out that respondents identified diverse types of difficulties: hard to solve technical ones, some caused by students' partial knowledge and skills, and some generated by incomplete infrastructure within faculty labs. Among these, difficulties caused by lack of the latest software and of licenses for using it were the most important ones. A solution during faculty classes is choosing open source software.

Although the practical activities during faculty classes and at technical courses that supposed using GIS were decisive for most respondents' training, our conclusion is that the present didactic activities are not enough for learning GIS because many respondents considered web tutorials crucial for their training. In conclusion, increased priority to learning and using GIS should be given in the curriculum.

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Assessing Territorial Planning M.Sc. Students using Facebook

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Abstract

Nowadays, there are diverse efficient methods and tools for assessing students' knowledge and skills. The Facebook socialising network does not aim at such assessment, but offers the context for dialogue among university students and also between them and their professors. Taking into account this feature of Facebook, our aim was not to use it as an assessment tool, but to use this attractive virtual environment as an optimum context for both learning and assessment. In order to achieve our aim, in a Facebook discussion group, we asked our students (at the M.Sc. programme of Regional Planning and Development at the Faculty of Geography, Babeş-Bolyai University, in Cluj-Napoca) certain questions in order to analyse a series of cultural landscapes using the approach of territorial planning. Through the respective questions, we focused on our students' in depth understanding of the interactions between natural and human territorial components and the possibilities to capitalise them for sustainable development. In the end, we analysed the quality of our M.Sc. students' answers.

Keywords: Virtual learning environment, Facebook discussion group, Geography higher education, Learning community, Assessment.

1. Introduction and Theoretical Background

Facebook online technology helped at incorporating learning into students' daily social media use (Lin et. al, 2016) and Facebook discussion groups are an additional educational tool assisting teachers to enable and advance their students' learning (Rap and Blonder, 2015). Student Facebook groups represent "a third space of 'school life' where students blend their personal, social life with academic schoolwork (Aaen and Dalsgaard, 2016, p. 160). Nevertheless, the role of social media in formal education remains contentious despite research showing that instructor-guided Facebook use can increase students' cognitive and affective learning (Akcaoglu and Bowman, 2016) and despite the positive impact of high conformity on students' intrinsic and extrinsic learning motivations when using Facebook course groups (Sun et al., 2016).

Facebook socialising network is an informal tool in organising discussion groups where members can co-operate while learning (Ellison et al., 2007; Dulamă et al. 2016a). Still, research also showed that there was a member typology and that lurking was the norm of Facebook groups (Asmaak Shafie et al., 2016). For instance, invisible and passive participants, although observing online activities, did not contribute to discussions and had four features characteristic of their statute as lurkers: poor online communication skills, no confidence, learning by lurking, and no sense of belonging (Asmaak Shafie et al, 2016, p. 1).

In Facebook Romania, there are numerous geographers' groups: *Club of Geography Teachers in Romania, Geographers and teachers, Geographical scientific events, Geographical publications*, etc.

Geography university students in Cluj have formed Facebook discussion groups that function as authentic Geography learning communities. In those groups, they solve geography issues, discuss certain topics, organise events, study diverse materials, and share the most interesting ones (Dulamă et al., 2015a; Dulamă et al., 2015b). The pre-university students in Romania learnt in discussion groups for their high school final exam, supported by teachers and for assessing their results (Dulamă et al., 2016a). Some students had active and proactive behaviour (sharing geography tests and texts, photos, maps, test solutions, etc.), while others got involved into discussions rather rarely, only if their colleagues and teachers encouraged them or when official assessment moments approached. They mostly used the discussion group for self-assessment, asking and answering questions (Dulamă et al., 2016a).

Taking into account certain features that Facebook has and render it as an informal e-learning platform, in this research we experimented how to assess geography university students' results in a closed Facebook discussion group. The aim of our research is to support the M.Sc. students enrolled in the educational programme of *Regional Planning and Development* at the Faculty of Geography, Babeş-Bolyai University, in Cluj-Napoca in order to observe certain rural cultural landscapes and to interpret/understand them thoroughly so that they are able to create territorial planning proposals (Dulamă et al., 2016b). The objectives of our research were the following: 1) analysing activities and interactions in the discussion group during an assessment activity; 2) analysing the information resulted through individual study of a series of photos shared in the discussion group, in comparison with the information quantity resulted while using an assessment tool for villages.

2. Material and Method

2.1. Participants and Procedure

We realised the experimental activity at the end of the 2015-2016 academic year. We created on Facebook a discussion group that we entitled *Cultural landscapes.* By e-mail/phone, we invited four M.Sc. students to enlist in the discussion group – two in their 1st year of study and two in the 2nd – from the educational programme of *Regional Planning and Development* at the Faculty of Geography, Babeş-Bolyai University, in Cluj-Napoca. At the Bachelor's level, three M.Sc. graduated *Geography* and one *Territorial Planning.* They volunteered to take part at this experimental research. The sample represents a very small part of the total population of the M.Sc. students at *Regional Planning and Development* in this faculty, and this limits generalisation of research results.

After creating the discussion group, we shared several photos with cultural rural and agricultural landscapes from Romania that had been previously shared on Facebook. The cultural landscape was defined as the expression of a lifestyle and of development in a certain community and territory (Sârbu, 2011) and we took those features into account when we selected the four photos that represented a large part of the built-up areas and outside the built-up areas of villages: *Charlottenburg (Timiș County)* (Figure 1), *Colțești (Alba County)* (Figure 3), *Prejmer (Brașov County)* (Figure 5), and *Rîmetea (Alba County)* (Figure 7).

Figure 1. Charlottenburg Village
(Charlottenburg village, 2016)

Figure 2. Charlottenburg Village
(Charlottenburg village, GoogleEarth, 2016)

Figure 3. Colțești Village
(TransylvaniaCam, 2014)

Figure 4. Colțești Village
(Colțești village, GoogleEarth, 2013)

Figure 5. Prejmer Village
(Prejmer Village, 2016)

Figure 6. Prejmer Village
(Prejmer Village, GoogleEarth, 2014)

Figure 7. Rîmetea Village
(Source: TransylvaniaCam, 2014)

Figure 8. Rîmetea Village
(Rîmetea Village, GoogleEarth, 2013)

Each student chose the photo of a village. Students expressed their options in the discussion group. During the first assessment phase, we asked each of them to describe scientifically and briefly the visible features of the landscape/village in the photo. Students could choose between sharing their answers on the discussion group and sending their answers on e-mail or in Facebook messages.

After they had solved the first task, we sent each student, by e-mail, the assessment grid of the village according to the respective photos (Table 1), so that they complete it and send their answers by e-mail. The grid includes six categories of elements, 15 elements, 50 questions associated to these elements, and 50 boxes for students' answers. Students' tasks when completing the grid were the following: to collect information from the chosen photo and from the received remote-sensing photo, not from other sources; their answers had to be brief (parts of phrases); to assess values to sizes and surfaces; they could leave uncompleted rows if they could not answer based on those photos; to give feedback to their professor about the questions in the grid. There was no learning activity between the two assessment ones, but analysing photos starting from the grid was mainly a learning activity. At the beginning of the activity, we informed our students about the tasks and that the activity lasted for a few days.

2.2. Data Collecting and Research Material

For collecting data we used on-line observation and interviews. We analysed: the activity in the discussion group; the students' four texts written for the first assessment; the grids that the students completed and sent by e-mail or on Facebook; students' answers to our questions at the end of research.

Table 1. Evaluation Grid for a Village, Based on Photographies

Category of elements	**Elements**	**Questions**
Natural components	Landforms	1. On which major landforms do you notice that the village built-up area lies? (hill, plateau or plain)
		2. On which micro formation of relief or part of the landform do you notice that the village lies? (interfluves, slope, meadow, or terraces)
		3. Which is the land declivity in the village built-up area?
		4. Which is the density of the land fragmentation in the built-up area?
		5. In what way has the respective landform favoured the appearance of the village?
		6. What landform features represent a risk factor for the village?
	Vegetation	7. Which are the visible vegetation associations?
		8. What is the percentage of forested surfaces outside the built-up area?
		9. What is the percentage of surfaces covered in grass or grassy

		associations (pastures and grasslands) outside the built-up area?
Built-up area	Shape of the built-up area	10. What is the shape of the village built-up area?
		11. Why do you think the village centre has this shape?
	Structure of the built-up area	12. How are the households distributed within the built-up area?
		13. What are the lots in between the houses used for?
		14. What is the size of the lots attributed to the households?
		15. Why do you think the village built-up area has this structure?
		16. What kind of village is it according to its built-up area structure?
	Texture (street network) of the built-up area	17. What does the street network look like?
		18. What is the street network layout within the village built-up area?
		19. How is the village built-up area organised?
		20. What is the texture of the village built-up area?
		21. Why the village built-up area has this particular texture?
		22. What materials do you think were used to build the streets?
		23. What is the percentage of asphalted streets?
		24. Where are the asphalted streets placed?
	Buildings/ households	25. How many buildings do you think there are in the village?
		26. How are the households arranged in the village built-up area? (depending on the street network)
		27. What are the components of a rural household?
		28. How are the households organised in the territory?
		29. Which is the predominant form of the houses?
		30. What is the maximum allowed height of the buildings?
		31. What are the houses covered with?
		32. Which is the dominant colour of the houses?
		33. On which side of the village built-up area are the school, the church and the village hall placed?
	Size	34. What length do you estimate that the rural settlement has?
		35. What width do you estimate that the rural settlement has?
		36. What surface do you estimate that the village has?
	Land use	37. What is the terrain in the village built-up area used for?
		38. What is the percentage of the built surface in the built-up area?
Land outside the built-up area	Structure	39. Which is the structure of the land outside the built-up area?
		40. What shape do the lots have?
		41. What size do the lots have?
	Land use	42. How is the land outside the built-up area used?
		43. What is the percentage of surfaces covered with orchards on the land outside the built-up area?
		44. What is the percentage of surfaces covered with vineyards on the land outside the built-up area?
		45. What is the percentage of surfaces covered with plough land from the land outside the built-up area?
Population	Number of inhabitants	46. What kind of village it is according to the number of inhabitants?
	Functions	47. Which functions does the village have according to inhabitants' main activity?
Favourability /risks	Favourable factors	48. Which are the external conditions (natural/man-made) that favoured the formation of the rural settlement?
	Risk factors	49. Which are the external conditions (natural/man-made) that represent risk factors for the rural settlement?
Landscapes	Types	50. What type of landscapes are the ones visible in the photos?

3. Results

In Table 2, we classified students' activities in several categories, and, in Table 3, we presented the scores they obtained during the two assessments.

Table 2. Students' Activities during the Experiment

Category of activities	Activities	Number of Students			
		1	2	3	4
Photos	Looking at the shared photos on the Facebook group	x	x	x	x
	Choosing the photo	x	x	x	x
	Looking for other photos on Google Earth	-	-	x	-
	Analysing photos	x	x	x	x
	Interpreting photos	x	x	x	x
Communication	Written communication in the discussion group	x	x	x	x
	Written communication through Facebook messages	x	x	x	x
	Oral communication on the phone	x	x	x	x
	Written communication through e-mail	x	x	x	x
	Transmitting the solving of task 1 through e-mail	x	x	x	-
	Transmitting the solving of task 1 through Facebook messages	-	-	-	x
	Transmitting the solving of task 2 through e-mail	x	x	x	x
Tasks	Solving task 1 (writing text)	x	x	x	x
	Solving task 2 (completing the table)	x	x	x	x
	Answering clarification questions through e-mail	x	-	x	-
	Answering clarification questions on the phone	-	x	-	-
Total		13	13	14	12

Table 3. Students' Scores at the Two Assessments

	Score		
	Assessment 1 (A1)	**Assessment 2 (A2)**	**Score difference (A2-A1)**
Charlottenburg	23	50	**27**
Colțești	12	50	**38**
Prejmer	18	50	**32**
Rîmetea	12	50	**38**

4. Discussions

4.1. Analysis of the Activities and of the Interactions in the Discussion Group

Role analysis within the discussion group. The professor had multiple roles: group *coordinator* and *organiser* (to create the group, to invite the students to join the group), *designer* of the assessment activity (search, selection and posting of the photos, phrasing tasks and requests, conceiving the assessment tool), *organiser* of the assessment (communicating the tasks and the requests for the completion of the grid, and for phrasing the questions about the solving manner), *observer* (monitoring each member's activities), *motivator and facilitator* (in solving the tasks), *evaluator* of the group activities and of the results. In the discussion group, students had roles in searching and in information processing: *researchers* (to search for photos), *materials providers* (to post photos online), *listeners/active readers, observers, analysts, investigators/researchers, scientific text producers, and senders of oral or written/oral messages, self-evaluators.*

Analysis of the members' activities within the discussion group. In Table 2, there is a classification of the activities. The students had on-line activities, associated with the photos shared on the group (observation, analysis, interpretation, comparison, text creation), they interacted with the other members of the group and with the professor. Communication using several means (Facebook, e-mail, phone) was initiated by the professor, in order to increase task solving motivation and to clear up aspects referring to the facilities offered to the Facebook discussion group.

Emphasis was on the fact that the discussion group provided the conditions for all the activities listed in Table 2, except for the search of the photos on Google Earth. We noticed one student's proactive behaviour, who searched for the settlement under analysis a satellite image and submitted it for an in-depth analysis of the rural settlement. We asked that student to search for such images for all the analysed villages, and the photos were sent to the group members. As down side was the fact that messages sent via Facebook to the professor were taken over by text copy in several stages. Therefore, this method is inefficient in transmitting the task solution.

4.2. Analysis of Students' Results

Analysis of students' results during assessment 1. The texts were elaborated relying on the photos (Figures 1, 3, 5, and 7) shared by the professor on the online group, observing requirements. The students described the visible aspects of the village scientifically, briefly, starting from the chosen photo. The texts were compact, without underlined subtitles. Each text was created relying on a different approach plan, which proved that students used efficiently their previous knowledge and skills, even if they could not integrate them in a Geography related competence, which was to analyse a rural cultural landscape. The analysis accomplished by the post graduate student licenced in *Territorial Planning*, which was much more systematic and which pointed out many more characteristics of the landscape, underlined the existence and use of competences characteristic of this specialisation.

During our quantitative assessment of the texts, the information provided by each text was counted. Thus, Table 3 shows that the pieces of information provided by each of the shared photos could vary from 12 to 23. The differences had several causes: the number of components of the rural, cultural and agricultural landscape in the photo; the image quality; the students' competence level, the allotted time for task solving, etc.

Analysis of students' results during assessment 2. The assessment tool of a village had as main purpose to guide the students in the analysis of village and therefore it included a list of 50 questions.

This tool had also the function of a check list, not just that of an analytic, descriptive, and assessment grid. The postgraduate students were not afore informed about the grading of these answers, since it was an informal, voluntary activity, with the objective of testing the grid and not for granting grades. In order to compare the results from assessments 1 and 2, each answer from the tables were considered informative and were granted 1 point.

The first postgraduate student to use the grid made us aware of the fact that he could not answer all the questions, and therefore he asked us whether he could use satellite photos taken from Google Earth (Figures 2, 4, 6, and 8). This proposal was accepted (since they were also photos) and all group members did the same. Consequently, they could all fill all the answer boxes.

Considering the fact that the main objective was to test the grid, at the beginning of the activity they were told to answer only the questions they could relying on the given photos. Analysing the information completed by the postgraduate students in the evaluation grid regarding the villages, we saw that they observed our requirements: a concise presentation, and making educated estimates, not real life measurements.

Table 3 shows that all postgraduate students got the maximum score, even though some answers might have had a higher degree of subjectivity and might have not observed scientific rigour. By using the grid in the study of those photos, the number of information pieces produced increased with a percentage from 54% to 67%, which proves its efficiency.

5. Conclusions

We reached several conclusions regarding the use of Facebook discussion groups by Geography students in e-learning and assessment in geography/territorial planning.

The activity within the Facebook discussion group does provide some advantages: various materials can be shared on the discussion group (tests, texts, photos, maps, charts, etc.); all members have access to the shared materials; each member receives via e-mail the shared materials and the carried out discussions; members can share online the solutions to the tests; they can ask questions, phrase answers and opinions; they can ask for support, or further clarifications, feedback from their professor or from their colleagues; members have also much to learn even as observers or passive readers. One thing which is most valuable for the assessment of the discussion group is the fact that all members can see their colleagues' solutions and can compare them to their own, thus realising inter- assessment and self- assessment. All group members benefit from the professor's constructive feedback on the discussion group.

There are also some disadvantages: the e-mail inbox is overflown with messages, but the group also has the *Notifications* option to stop the posts; one member can be included in the group without knowing or wanting it, but the button *Joined* has the options *Unfollow* or *Leave group*; students' materials are subject to the others' assessment, but group members should be encouraged to show empathy.

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Generator of Tests for Assessing Knowladge

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Abstract

An important component in learning is testing. The purpose of testing is to measure the capacity to assimilate knowledge and to use it in solving specific issues of learning. The most easily accomplished tests use multiple choice questions, in case which only one or more of the answers are correct. To have the best possible security of the assessment using such tests, it is useful and necessary that the used tests to be as different while keeping the same questions and possible answers. To get such tests we will swap questions and variants using two algorithms that will be present in this paper. One method uses backtracking algorithm combined with a random generation algorithm and other uses only random generation. For each algorithm results obtained using C++ implementation are presented.

Keywords: e-learning, test, random, backtracking

1 Introduction

It is known that testing is an important part in the process of learning. While some people are used to test themselves outside the academic environment by handling with particular challenges such as interviews, some are in the situation when they need to pass a test or an exam. For those in the second category the multiple-choice test represents the simplest and efficient method to assess their level of knowledge on a specific subject. For the development of such tests a huge amount of time and energy is required if it is done manually, so finding a solution which decreases it is a vital issue. This paper focuses on generating multiple-choice tests in a simple and fast way, to make the work of the teachers or assessors much easier.

At this moment, there are numerous models of generating tests using various ideas, for example in [5] and [7] are presented 2 test generators using genetic algorithms, in [6] is presented a way to generate tests using keywords from the questions' text and notions of graph theory, in [9] are used notions of statistic for generating tests, etc. These generators are used in various e-learning platforms, such as the one presented in [10] and [11].

In this paper we will present two modalities to create tests as different as possible using a set of questions which has a sequence of answers each. The first method uses backtracking algorithm combined with a random generation one, while the second one in based only on random generation.

In section 2 will present an example for the problem of tests generation along with the notations we will use when presenting our algorithms.

In section 3 and 4 we will explain the two algorithms: the one that combines backtracking with random generation will be presented in the 3 section, whereas the algorithm which uses only random generation will be presented in the 4 section.

The results obtained after their implementation in a C++ programming environment will be placed in the 5 section.

2 Assessment using multiple-choice tests

The assessment represents a fundamental part in learning process. In the academic environment we find various structures of tests that have the purpose to help teachers determine the level of knowledge each student gained after a period of studying. Although there are plenty of ways to evaluate a student, the simplest and efficient one is the multiple-choice test. This approach of testing allows respondents to select the correct answer out of the choices from a list.

In this paper we will present two modalities of multiple-choice test generation having at hand three parameters:

- the number of tests we want to generate : NR;
- the number of questions in each test: n;
- the number of answers for each question: r;

We want to generate tests as different as possible formed from questions and answers codified by numbers from 1 to n and 1 to r. Two tests are considered different if they differ by the order of at least one question or by the order of at least one answer choice. Furthermore, the number of tests, questions and answers will be introduced by the teachers in a text file:

date.in and the generated tests will be centralized in a second text file: **date.out**.

An example for our problem is presented next:

date.in
3 4 3 (NR=3, n=4, r=3)
date.out
Test 1
Question 1 answers: 3 4 1 2
Question 2 answers: 2 4 3 1
Question 3 answers: 4 1 3 2

Test 2
Question 3 answers: 1 3 2 4
Question 1 answers: 4 3 2 1
Question 2 answers: 4 2 3 1

Test 3
Question 3 answers: 2 4 1 3
Question 2 answers: 2 4 3 1
Question 1 answers: 4 3 1 2

3 The algorithm that combines backtracking with random generation for generating tests

In the generation of tests we can use various ideas, as presented in paper [8]. In this paper we will present a method of generating tests which is based on the backtracking method (details can be found in [1], [2]) and the random generation of permutations using the random function defined in the languages C/C++ and Java compilers.

The method backtracking will be used to generate the permutations of the questions and the random generation will be used for determining the order number of tests and the order of answers.

The order of questions is retained in the bi-dimensional array a[][], on each line we will find a test (a permutation of the questions numbered 1,2,...,n) and the order number of them in the array y[]. We will consider the vector's lexicographical order, for ordering the test.

The sequence of instructions that determines the vector y is the following one:

```
f=1
for i=1 to n do
  f=f*i
endfor
for i=1 to NR do
    do
        y[i]=1+rand()%f;
        sw=0;
        for j=0 to i do
            if y[i]==y[j] then
                sw=1;
                break;
            endif
     while sw==1;
 endfor
```

We consider the fact that the previous sequence is written in the function geny() without parameters and the generation with the backtracking method of permutations and the retaining of those which are with the order number y[1], y[2], ..., y[NR] is realized by the back function and the core of the algorithm is presented below:

```
geny()
  back(1)
  for i=1 to NR do
      write "Testul ", i
      for j=1 to n do
          write "Intrebarea ", a[i][j], " variante: "
          for L=1 to r do
              do
                  v[L]=1+rand()%r
                  ok=0
                  for L1=1 to L-1 do
                      if v[L1]==v[L] then
                          ok=1
                          break
                      endif
              while ok==1
          for L=1 to r do
              write v[L], " "
          write '\n';
      endfor
  endfor
```

The function rand () returns a natural integer randomly generated and the operator % is used to determine the rest after dividing the 2 integers.

In section 4 we will present an algorithm which eliminates the generation of permutations with backtracking method, obtaining an algorithm with a better runtime.

4 The algorithm of random generation of the permutations

The second method of multiple-choice tests generation uses only random generation. We will start the description by setting up the main components of the algorithm such as the input and the output data, the structures and the functions we used in our program.

To begin with, the input data consists of three parameters: the number of tests NR, the number of questions per each test n and the number of answers each question has r. The output data can be found after the generation in a text file:"date.out.txt" and it represents the needed tests, each one having the questions and answers codified with number from 1 to n and 1 to r.

In the algorithm which will be presented next we will use two arrays p and f with the components p_1, p_2, …, p_r and f_1, f_2, …,f_n in which pa/fa has the value 0 if a has been generated, respectively 1, if a has not been generated. The number a is generated with the rand function and when it has the value 1 it is directly centralized in the output file. After this step, the algorithm has to look up another value that was not generated by increasing the value of a by 1 until it reaches the maximum value (n for the questions and r for the answers), when a takes the value 1. Because we want to generate different tests we use srand(time(0)) function (in programming languages) before we call the rand function and that allows us to get a different value each time we use the random generation. The algorithm of generating the permutations is:

```
read n
  for i=1,n do
            fi = 0
  endfor
  for i=1,n do
            srandom(time(0)+nrt*A+i*B)
            a = random(n-1)+1
            while fa == 0 do
                         a=a+1
                         if a>n then
                                  a=1
                         endif
           endwhile
           if fa == 1 then
                      write a
                      fa=0
          endif
  endfor
```

where A and B are numbers with minimum 9 digits. Example: A=51245465511545, B=65581481818448481.

Observations

The random function returns a number randomly generated from the set {0, 1, …, k-1}, where k is a parameter for the function.

In the srand function we add to time(0) some big numbers multiplied with variables for a different value each time we call the rand function.

The algorithm described above is just for generating the questions, because the answers for each question are generated using the same method.

Furthermore, we use a variable nrt which represents the number of the current test to stop the program when we have generated a number NR of tests, as needed. An example with the resulted tests after the C++ implementation is presented in figure 1.

Example: NR=4 , r=5 , n=7			
Test 1	*Test 2*	*Test 3*	*Test 4*
Question 1 Answers: 1 5 2 4 3	Question 5 Answers: 4 5 3 1 2	Question 3 Answers: 3 2 4 5 1	Question 1 Answers: 1 2 3 5 4
Question 5 Answers: 4 1 2 3 5	Question 3 Answers: 2 3 5 4 1	Question 1 Answers: 1 2 3 4 5	Question 5 Answers: 5 4 1 2 3
Question 3 Answers: 5 4 1 2 3	Question 7 Answers: 3 4 5 2 1	Question 5 Answers: 2 3 1 4 5	Question 3 Answers: 1 5 2 4 3
Question 7 Answers: 3 2 4 5 1	Question 6 Answers: 1 2 3 4 5	Question 2 Answers: 5 1 4 2 3	Question 2 Answers: 4 3 5 1 2
Question 4 Answers: 4 5 3 1 2	Question 2 Answers: 3 2 4 1 5	Question 7 Answers: 3 1 5 2 4	Question 6 Answers: 2 1 4 5 3
Question 2 Answers: 2 3 1 4 5	Question 1 Answers: 1 5 2 4 3	Question 6 Answers: 4 5 3 1 2	Question 4 Answers: 3 2 4 5 1
Question 6 Answers: 5 3 2 4 1	Question 4 Answers: 4 3 1 2 5	Question 4 Answers: 2 3 5 4 1	Question 7 Answers: 1 2 5 3 4

Figure 1. Example for C++ implementation

5 Results of C++ implementation

In order to show the efficiency of the two algorithms that we have presented, we made an implementation in C++ programming language. The calculations for the runtime were run in a Microsoft Windows 10 environment, on a machine equipped with a 2.50GHz Intel Core i5 processor which uses a 4 GB RAM memory. Moreover, the section VI comprises the conclusions and future work.

The tables and the charts we will present next uses the following notations for the input data:

-NR (the number of tests)

-n (the number of questions per each test)

-r (the number of answers per each question)

For example, we will consider a battery of 11 tests for each algorithm:

n	r	NR	Runtime
4	6	3	0,041
9	10	7	0,177
5	5	3	0,042
5	5	10	0,043
5	5	100	0,046
7	5	100	0,049
9	50	100	0,298
9	100	100	0,367
3	8	2	0,044
3	20	6	0,043
10	5	3	0,997

Figure 2. Runtime for the first algorithm

n	r	NR	Runtime
4	6	3	0,130
9	10	7	0,113
5	5	3	0,110
5	5	10	0,099
5	5	100	0,115
7	5	100	0,106
9	50	100	0,168
9	100	100	0,275
3	8	2	0,098
3	20	6	0,103
10	5	3	0,098

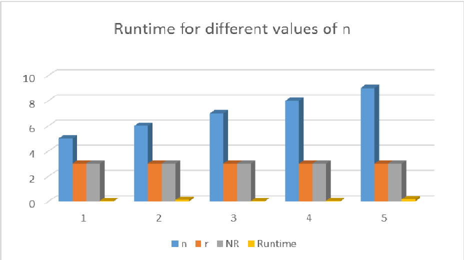
Figure 3. Runtime for the second algorithm

It can be seen from figure 2 and 3 that the two algorithms doesn't have a major differences regarding the runtime, both of them having the execution value bellow 1 second. Furthermore, the difference between the first measured element and the latest is also smaller than 1 second. This is not an extremely significant difference, given the fact that the number of generations almost doubles.

To continue, we developed 4 charts and tables which will be presented next to show how the runtime changes when we keep the same value for 2 of the 3 parameters we have:

n	r	NR	Runtime
5	3	3	0,044
6	3	3	0,121
7	3	3	0,045
8	3	3	0,055
9	3	3	0,174

n	r	NR	Runtime
5	3	3	0,053
6	3	3	0,046
7	3	3	0,048
8	3	3	0,046
9	3	3	0,048



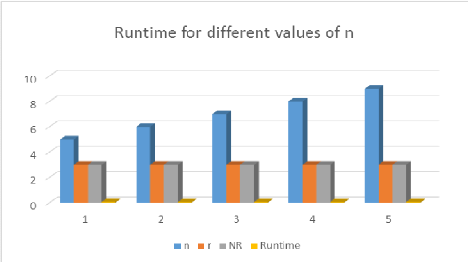
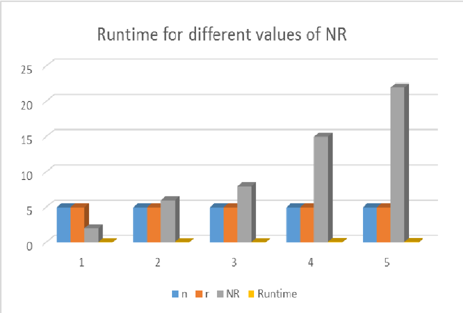


Figure 4. Runtime for the second algorithm

n	r	NR	Runtime
5	5	2	0,049
5	5	6	0,048
5	5	8	0,046
5	5	15	0,094
5	5	22	0,097

n	r	NR	Runtime
5	5	2	0,043
5	5	6	0,045
5	5	8	0,046
5	5	15	0,098
5	5	22	0,099



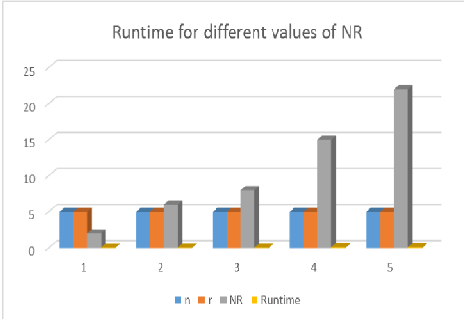


Figure 5. Runtime for the second algorithm

As we can see, the increasing of NR in figure 3 and figure 4 and the increasing of n in figure 5 and figure 6 does not influence very much the runtime of the algorithm. The number of tests in the Figure 3 and 4 influences in a minor way the runtime, the biggest increase being shown in case in which we want 22 tests. The difference between the first measured element and the latest is 0,130 seconds (from 2 to 22 test generation), all four models of charts being based on a linear progression.

6 Conclusions

The method of tests' elaboration using same questions and answers from this article assures teachers a correct evaluation and secure of the students.

The algorithms presented in this paper can be used on the existent platforms, such the ones that are presented in [8] or in learning applications that use the knowledge assessment of the students in a classroom.

For the future we propose to realize an online learning application which contains a generator of tests using the algorithms presented in the paper.

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Easing the Teacher Tasks in Assessment: An Overview on the Performance of Different Methods of Test Generations using Unrelated Questions and Certain Restrictions

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Abstract

The assessment is a crucial process within education, because it stabilizes and helps at consolidating the newly-incorporated information and abilities. We propose in this paper to make a review of some methods of forming tests used in assessment. These methods of generating tests are based mainly on genetic algorithms and are built based on certain restrictions, such as keyword labelling or degrees of difficulty. We will focus on the performance of these algorithms, in the same time presenting an example of a reliability of the methods used for its usage in real situations. While easing the teacher tasks related to evaluation, the genetic generation of tests has important implications in the technology-based means of assessment.

Keywords: Test, Assessment, Genetic, Restriction, Keyword

1 Introduction

Whether the assessment is made on the traditional paper or using more sophisticated online platforms, its purposes and implications in the educational processes are the same: stabilising the gained knowledge of the learner.

In this matter, the choice of the closest to optimal items used for education is a step that contributes critically to the efficiency of the assessment. This paper looks over certain methods used for generating tests. These methods are based on genetic algorithms (Gonçalves, 2011; Larrañaga, 1999) that are used for generating questions, which are unlinked or unrelated to each other, to form a test. Relatedness refers to the connection between two questions regarding a key characteristic (such as the degree of difficulty, the results from one questions used at the next one etc.). Some restrictions can be applied to this generation and in this paper we will show restrictions based on keywords and degree of difficulty. These restrictions will refer to defining the introduction of keywords and the degree of difficulty.

2 Previous Work and Literature

In previous papers we presented in detail some useful methods for generating tests formed of questions which are linked by some characteristics (such as degree of difficulty or notions) using either arborescent structures, random generation or genetic algorithms (Popescu, 2005; Popescu, 2008; Nijloveanu et al, 2015). Both the cases of linked and unlinked questions were studied, the difference being purely based on this characteristic. Related methods can be used to enrich the present algorithm (Popescu 2006, 2013, 2015).

The basic idea of functioning in case of keywords is that the user has a list of keywords that wants to be treated within a test. A question is selected if at least one of the keywords of that question matches with one of the keywords given by the user.

For the other restriction, the degree of difficulty is quite clear: the harder the question, the lower the degree of difficulty is. However, we introduced a method of selecting questions based on their theoretical (TDD) and practical (PDD) degree of difficulty (Popescu et al, 2016). Basically, given the two values for each question, the degree of difficulty is calculated dynamically based on the user's need for theoretical or practical aspects of questions.

3 Description of Methods

Basically, the method used for generating tests is broadly similar, the differences consisting in the modification of genetic operations used in the genetic algorithm and in the restrictions added for obtaining variations of questions.

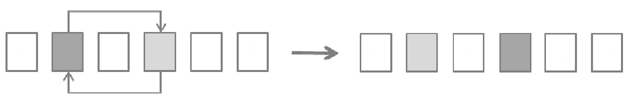
Firstly, an initial condition of the general method is the existence of a pre-built database of questions. Each question is characterized by a number from 1 to the total number of questions, by a statement and a list of keywords which summarize best their content. Optionally, depending on the type of question, other characteristic can be added, such as the options for answer (in case of multiple-choice questions) or the solving time (if the question is timed). The database can be built during a period of time by the assessor and take various forms, from a MySQL to a simple file, depending on the implementation programming language of the method.

In general, the chromosomes are the tests themselves and a gene within a chromosome represents a question within a test. In order to ease the generation, every question is codified within the algorithm with a number from 1 to the total number of questions in the database, than the question are de-codified and output in a user-friendly form.

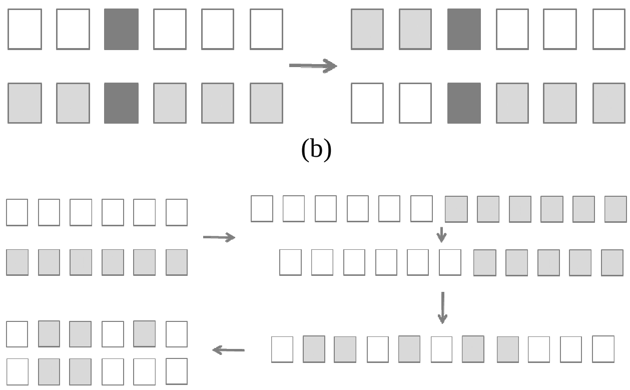
The method itself uses a genetic algorithm that uses as operations the mutation and the crossover with one point. The way these are implemented can differ and we used two different approaches:

- for mutation, we used a method that is based on replacing a gene with another gene generated randomly;
- for crossover:
    - we randomly chose two chromosomes and we randomly picked a position within these two chromosomes. Afterwards, in the first chromosome, we replaced its second part delimited by the chosen position with the second part of the second chromosome and for the second chromosome we replaced its first part with the first part of the first chromosome (type A);
    - after the random choice of two chromosomes, they are joined to form a big chromosome. After the removal of the identical genes, the first chromosome is made from the first genes and the second one is made from the latter genes (type B).

The graphical representation of the operations used is shown in Figure 1.



(a)



(b)

(c)

Figure 1. (a) Mutation, (b) crossover type A and (c) crossover type B for the described methods

As fitness function, in the case of existence of keywords, the most usual fitness function is the sum of keywords in the chromosome that match with the ones given by the user. In case of the existence of the restriction based on TDD and PDD, the fitness function is represented by a value calculated using these values and the values given by the user for what he wants to select. The equation for the fitness value for a chromosome in this case is presented in Equation 1.

$$DD = \frac{(TDD \times \alpha) + (PDD \times \beta)}{\alpha + \beta} \quad [1]$$

Basically, the general structure of a genetic algorithm used in these cases is:

Step 1. The input data is read. Depending on the situation, several variables are read such as the number of questions in the database, the number of questions desired in the test, the number of generations and the questions themselves.

Step 2. The initial population is generated randomly. After that, the fitness value for each chromosome is calculated.

Step 3. The mutation is then applied to the existent population. Either of the two methods can be applied. This step is iterated for a number of times equal to the read number of generations. After each iteration, the fitness value is calculated for each chromosome and then the chromosomes are sorted by their fitness value.

Step 4. The crossover is applied to the existent population. Again, this step is iterated for the same number of times, the fitness value is calculated and the chromosomes are sorted.

Step 5. After the completion of the iterations, the first k ($1 \leq k \leq$ number of genes) chromosomes are output.

4 Example and Results

comparatie intre runtime pt operatiile genetice

We will take now an example of a generation, in order to state the behaviour of the method. We base on the input data:

- n = 10 (number of question within a database)
- m = 5 (number of questions desired to be in the test)
- NoGen = 1000 (number of generations)

The questions are presented in Table 1.

No. of question	Statement	Degrees of difficulty		Keywords
		TDD	PDD	
1	Which is the type used for characters in Java?	0.90	0.10	char, type
2	Which is the solution for the equation 100*x=200?	0.40	0.60	equation, unknown, integer
3	Which is the integer which solves the inequation 2^x<1024?	0.30	0.70	integer, type
4	Which is the account that registers the VAT in lei?	0.85	0.15	accountability, VAT, lei
5	If 1+1=0, then 0+1=...?	0.20	0.80	binary
6	How many MB has a GB?	0.95	0.05	megabyte, gigabyte
7	Where are located the Carpathian Mountains?	0.95	0.05	geography, mountain
8	Write down the backtracking function for the dames problems.	0.01	0.99	backtracking, dames
9	Which is the basic cell of the brain?	0.98	0.02	brain, neuron, cell
10	Write down the most important parts of a genetic algorithm.	0.90	0.10	genetic, algorithm

For the values α = 0.9 and β = 0.1, the values are presented in Table 2.

No	Statement	Total degree of difficulty	TDD	PDD
10	Write down the most important parts of a genetic algorithm.	0.820	0.90	0.10
6	How many MB has a GB?	0.860	0.95	0.05
5	If 1+1=0, then 0+1=...?	0.260	0.20	0.80
8	Write down the backtracking function for the dames problems.	0.108	0.01	0.99
4	Which is the account that registers the VAT in lei?	0.780	0.85	0.15

The questions are chosen as wished, mostly the ones with a higher TDD than PDD are shown. The algorithm had a runtime of 0.38 seconds.

Now we pass to the other method, based on keywords. For the set of keywords {*integer*, *char*, *type*, *megabyte*, *backtracking*, *genetic*}, the values are presented in Table 3.

No	Statement	No. of keywords from TG
8	Write down the backtracking function for the dames problems.	1
10	Write down the most important parts of a genetic algorithm.	1
6	How many MB has a GB?	1
3	Which is the integer which solves the inequation 2^x<1024?	2
2	Which is the solution for the equation 100*x=200?	1

The algorithm used for generating these questions had a runtime of 8.16 seconds.

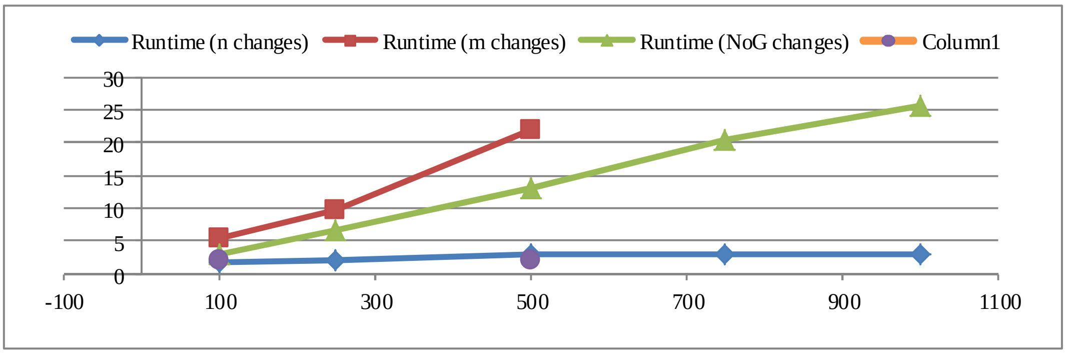


Figure 2. Runtime for some instances of the algorithms presented above

As we can see, the runtime depends more on the number of questions from within a test and the number of generation, less than on the number of questions from the database. The purple dots represent the runtimes for the method based on TDD and PDD and it can be sen that they are quite similar to those presented with the one that uses keywords.

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Synchronising Types And Levels Of Knowledge Within A Newly-Formed Class: A Method Based On Clustering And Peer Mentorship

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Abstract

In cases of formation of different instances of classes, whether if it is formed of children or adults, the novelty brought by a different context of learning and the emotional effort to create new relations with the colleagues raises some kinds of issues. One of these major facts to be dealt by the teacher is the difference of knowledge between the learners. The purpose is not at all the equalization of these levels, but, on the contrary, the teacher must contribute to the individual development of each learner, while developing the general performance of the group. In this paper we will present a continuation of research on some metrics regarding the establishment of the levels of knowledge, and, based on the determined results, develops a method based on key concepts such as the clustering in two major groups, group learning and mentorship between the peers.

Keywords: Mentorship, Peer, Cluster, Education, Knowledge

1 Introduction

Forming a class is a normal moment within education. While this is inherent, some issue regarding cohesion between peers, whether they are adults or children, arise during the formation of a new class (Sabine et al, 2012). Another problem consists in the differences between the levels of knowledge between the students that come from different institutions or have different styles of learning whether the institution of origin.

A solution that was proposed in previous papers and continued in this paper is based on three key components: the formation of clusters of students, the learning in groups and the peer mentorship. While in the previous paper, we focused mainly on the description of the three components, in this paper we will present an extension of the method of forming the two clusters of students. The novelty brought to the past papers is the addition of several characters besides the general knowledge of a student, which take into account the social and extracurricular activities, taking into account also the emotional intelligence and social networking. The clusterization is made depending on a specific concept to be taught. Depending on the notions that must be taught, the clusters are formed dynamically.

Section 2 will present the framework of the general method used within the educational process. In section 3 the description of the modality of forming the two clusters is shown, while section 4 will contain several conclusions and draw certain future directions for development.

2 Related Work

The general framework of the whole method is based on the clusterization of the students based on their knowledge reported to a specific concept. This initial partition into two clusters is made based on an initial test that is given to the students. An initial test would be given to establish all the characteristics (knowledge, emotional intelligence, networking etc.) of a student, then, intermediate tests would be given which would measure only the general level of knowledge. This shows the importance of a correct test that must be given in order to cluster the students into the correct partition.

Besides this important component, other two main modules of the model drift from the first one use some methods and systems that use technological tools and peer mentorship in order to learn a specific concept from peers (Popescu, 2010). The advantages of peer mentorship and group learning are obvious, due to the relations that form within the groups (Colvin et al, 2010; Santucci et al, 2008). The general framework is presented in Figure 1.

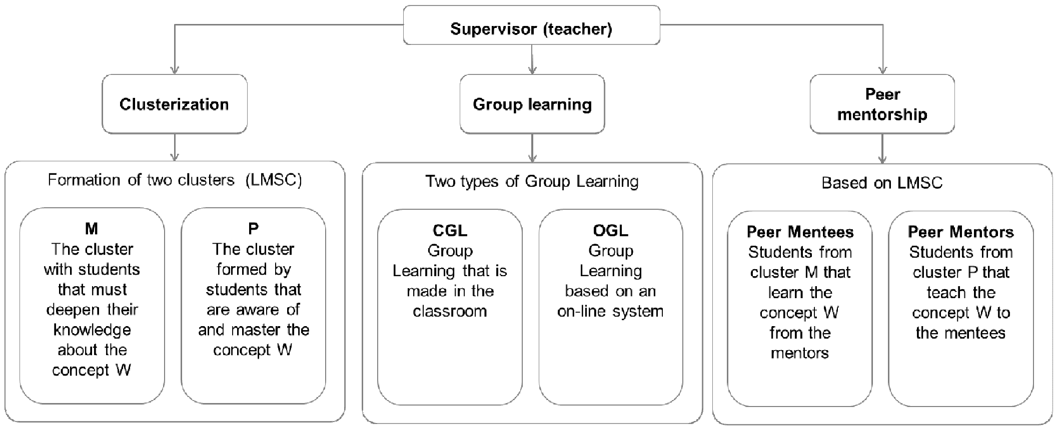

Figure 1. The general framework of the model

3 Description of the Method

We have presented a method that forms the clusters based on two main parameters: the level of knowledge calculated based on an initial test and the school of origin (Popescu et al, 2016). The two formulas are shown in equations [1] and [2].

$$[1] \quad LK = \frac{0.75 \times TR_i + 0.25 \times DC_j}{0.75 \times 0.25}, \ \mathrm{i} = (1, \mathrm{N_{St}}), \mathrm{j} = (1, \mathrm{K})$$

$$[2] \quad TR_i = \frac{\text{no of known concepts } (\mathrm{W_z} \ \text{ where } \mathrm{T_y} = 1)}{P}, z = 1, P, y = 1, K$$

TR is calculated as a ratio between the number of known concepts at the test and the total number of concepts and represents the most important part of the method. For a given number of concepts to be studied within a module, this index can be calculated as initial start for the level of knowledge for each student. DC represents the degree of confidence of the origin institution and can be calculated depending on the average mean of admittance or the ratio between the enrolled students and the graduated ones (in case of educational institutions) or any indicator that shows the efficiency of the personnel – e.g., the proportion of submitted projects related to the total number of projects (in case of non-educational institutions).

The equation [1] can be used for cases of determination of only the rational part of the education. We know that education has not only rational aspects, but also implies emotional and relational components. Thus, in the process of establishing the clusters we must also take into consideration these components.

Measuring emotional aspects is a tricky process, given the facts that emotional intelligence is hard to be measured by their nature. However, we can approximate this component by measuring the amount of extracurricular activities and the networking component by measuring the number of connections on a specific social platform.

We will take into consideration the next parameters:

- TR (the test results for the knowledge of each student);
- DC (degree of confidence of the origin institution for each student);
- NF (number of connections on a specific social platform, chosen by the teacher);
- NC (number of contests of any type that the student participated in a period of time);
- EC (number of extracurricular activities that the student participated in a given period of time; extracurricular activities may refer to any type of activity that exercise the student's abilities and competences);

Giving specific proportions to each index and extending the equation (1), we will obtain the equation [3]:

$$[3] \quad LK = \frac{\alpha \times TR + \beta \times DC + \chi \times NF + \delta \times NC + \varepsilon \times EC}{\alpha + \beta + \chi + \delta + \varepsilon},\ 0 \le \alpha, \beta, \chi, \delta, \varepsilon \le 1$$

The values of every index are reduced to a number from 0 to 1 by division. LK is then compared to the mean of all the LK's and then the participants are clustered either in M (if LK is lower than the mean) or cluster P (if LK is higher than the mean).

We will extend the example (Popescu et al, 2016) and we will show how the method works for a given example. For α=0.3, β=0.2, χ=0.1, δ=0.1, ε=0.3. The values are grouped by institution and calculated as mean of the individuals from each institution, in order to keep the previous structure, but also due to the lack of certain data. NF is considered to be the number of students subtracted by 1, taking into consideration only the inner friends (from the newly-formed class only) and starting from the supposition that the students from the same school are acquainted better to each other.

Institution (SC_i)	DC	Number of students	NF	NC	EC	TR	LK	Cluster
“Eugen Ionescu” School	0.90	12	11	4	8	0.50	0.621	P
School no. 7	0.74	2	1	2	3	0.25	0.334	M
“Radu Greceanu” National College	0.84	2	1	5	5	0.50	0.519	P
Ianca School	0.66	1	0	1	1	0.25	0.247	M
School no. 3	0.72	2	1	2	2	0.25	0.3	M
“Constantin Brancoveanu” School	0.76	4	3	3	4	0.25	0.38	M
Sport-Scheduled High school	0.74	2	1	2	2	0.25	0.304	M

Table 1. Extension of the example from the previous paper

The same coefficients will be drawn to another example, this time for a class of adults taking a course. For this example, the concepts are, in order:

- the usage of Windows Explorer (W_1);
- open and save of files in Office Word (W_2);
- usage of styles in Office Word (alignment, indentation, fonts, tables, images, charts, page setup, orientation etc.) (W_3);
- generation of documents using Mailings (W_4).

The results are shown in Table 2 for the notion W_3.

Participant	Institution	TR	DC	NF	NC	EC	LK	Cluster
1	“Mircea cel Bătrân” National College, Constanța	0.75	0.91	868	4	7	0.45778	M
2	CCD Caraș Severin	0.75	0.94	3302	4	35	0.49652	P
3	„G-ral D. Praporgescu” Technical College, Turnu-Măgurele	0.50	0.95	753	3	5	0.37903	M
4	CCD Olt	1.00	0.93	608	3	7	0.52418	P
5	APC Slatina	1.00	0.95	495	2	5	0.51645	P
6	CCD Vâlcea	0.75	0.94	2206	4	32	0.48466	P
7	CCD București	0.75	0.91	1200	2	8	0.4414	M
8	CCD Hunedoara	0.75	0.92	1772	3	6	0.45852	M

Table 2. The simulated class with the characteristics of students

The two clusters that will form based on averages are:

- M with participants 1, 3, 7 and 8;
- P with participants 2, 4, 5 and 6.

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Methods for Teaching Programming Using Virtual Laboratory

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Abstract

Contemporary methods and forms are analyzed in the paper. Teaching forms and methods implemented in Faculty of Technics and Technologies – Yambol are introduced and compared in the Virtual Laboratory environment: explanatory-illustrative method; programmed method; heuristic method; problem solved method; model made method (V.A. Oganessian classification). The matrix of traditional and contemporary methods and forms is introduced. There is guidance for using a virtual laboratory in programming for a more comprehensive and effective implementation of the methods in the reviewed classification.

Keywords: Virtual laboratory, teaching methods, teaching forms,

1 Introduction

Teaching programming is a key part in learning informatics and includes abstract concepts and operators of program language, algorithms and data structures. Different training methods, implemented using various forms, can be used in orderto gather theoretical knowledge in this area, acquire practical skills, needed for creating code and develop algorithmic thinking. The widespread use of modern information technologies by students in their daily lives requires a search for new forms of teaching methods and education that are familiar to the new generation.

The aim of this report is to present a comparative analysis of the use of virtual laboratories and traditional forms of education, such as lectures, practical exercises, coursework and independent extracurricular work, and give guidance for their use in order to achieve better learning outcomes in programming.

Babateen (Babateen,2011) summarizes some of the characteristics of virtual laboratories (VL), which can be viewed as advantages for their use in education. The characteristics that are valid for, and should be taken into account, for teaching programming using virtual laboratories (VL) are the following: Creating a new intellectual model in education that better than the existing and more beautiful that the imagined one; Constant gathering of knowledge and mastering thestudy material; Encouraging and guiding the students; Registration of student data and automatic evaluation; Possibility for constant update.

As an addition to these advantages of VLs, the following ones can also be added, which are provided in different articles and have been summarized by the following author (Shivacheva, 2016). We will list only those that relate to teaching programming: VLsare suitable for explanation of concepts (fundamental concepts and ideas);There are no restrictions such as time and place; They are economically viable; Once implemented they can be used repeatedly and by unlimited number of people;A simulation can be run as many times as necessary until the student understands and accepts the concept or algorithm, presented by it, when using a programming VL; The use of VLs allows for independent work at a pace that is typical for the student, without the need to comply with others; Enables the visualization, animation and simulation of abstract concepts that students perceive with difficulty, if provide and described only in a text (or verbally);It helps for the easier understanding of some algorithms that can be followed step by step;Most VLs allow thes ynchronous and/or asynchronous communication with other users - teachers and students located around the globe; It allows for a teamwork on joint projectsby people that are not in the same place, and even not at the same time; Itprovides conditions for electronic and distance learning; It allows for teaching people with special educational needs who have difficulty with transportation to school, but which have no problem to use a computer and the Internet; There are simulations, which allow the selection of the speed of execution of the command by the trainee –either lower or higher;There are simulations that allow a step-back return (undo). This way an algorithm can be traced to a detail and allows for the easier understanding by the student.

2 Materials and Methods

Virtual Laboratory for Training in Programming (VLTP) is a not just a substitute for lectures and practical exercises in the computer lab. It provides the means and methods for the step-by-step visual representation of the algorithm execution, and not just as a rows of numbers and text, but also visually, with the help of geometric shapes (e.g. rectangles of varying heights proportional to the value of the number they figure), which enhances the visibility and reduces the abstraction of the algorithm. To fulfill its purpose VLTP should include a theoretical part, a source code, and animations, simulations and visualizations associated with the respective academic unit. In addition, it should include synchronous and asynchronous communication between the teacher and other students, and should also include the possibility for testing the gathered knowledge, and should also contain information about the learning level achieved using the VL

Under method of training in informatics in the university we understand the regulated interconnected activity between the teacher and the student, aimed at achieving the objectives of teaching informatics (Babanski – in Zhuzhzhalov, 2004).

For the purpose of our study we took into account two classifications of teaching methods. The first classification we discuss,is according to the mode of transmitting information from teacher to student. The methods are: **verbal, visual and practical** (Zhuzhzhalov, 2004).

According to V. Zhuzhzhalov while teaching programming to students the lecturer can use both **verbal** (lecture presentations) and **practical** methods (implementing mandatorylaboratories, workshops, problem solving tasks). The practical work done (both real (hands-on) and mental tasks) is prevalent for the students, and a particular role is saved for independent thought processes, allowing for the implementation of selection of data and decision tasks (Zhuzhzhalov, 2004).

Verbal methods for teaching programming can be used both in the materials for e-learning, as well as the theoretical part of each interactive teaching units of the VLTP modules. The practical methods are implemented in the execution of simulations that use a student given data input when using VLTP. According to us, the lecturers can also use visual methods - flowcharts for describing and visualization of algorithms. During the **lectures and the practical exercises** some of the algorithms can be presented using short animations that visualize an analogical example in real life - such as the algorithm for changing the values of two variables as compared to the analogically equivalent changing of contents of two glasses using a third empty glass (ie. the third auxiliary variable). In **VLTP**there is a distinct part of the learning resources that is used for visualization, animation and simulation of concepts, operators of program languages, algorithms and data structures, which are suitable for a presentation in this type of learning platform. This is done in order t lower the level of abstractness of information and to increase the level of visibility of information, to allow the easier perception of such concepts.

According to the classification of Oganessian (Oganessian,W.A. et al., 1980), methods of teaching are:

- Explanatory-illustrative or reproductive method;
- Method of programmed training;
- Heuristic method;
- Problem-solving method;
- Model made method.

Explanatory-illustrative or Reproductive method (EIMd) is basically remembering the already thought material and its reproduction.

The method of programmed training (MdPgT) stems from the fact that the actions of the student are clear about what one should do and the sequence of actions following, i.e. they are programmed and planned in advance. After performing the first of these planned actions, the student goes onto the second part, then after its completion steps onto the third part and so on until producing the intended results.

If by using this method of programmed learning only the interim results are visible, but the method for achieving them is not clear, then one should use the **Heuristic method of teaching** (HMdT). This method of reaching the intended results is repeated at each intermediate level usinga heuristic search.

When the intermediate results and the path for their achievement is known, it may lead to a conflict between the results that are important for solving the task and the outcomes that are needed. If this is the case, then this is called as problematic situation, i.e. the demand already has a complicated character and is called the **Method of problem training** (MdPrT).

In all these cases the student knows what the final results are. They can be reached using additional independent extracurricular assignments, special types of decision-making tasks and others. According to the level of understanding of a given task the student receives the results and compares them with the ones stipulated by him. If he has not reached the final results, he has to once again go through all the steps. This method is called **Method of model made training** (MdMT). Under certain conditions this method can be combined with the heuristic method.

3 Discussion and Results

The programming education at FTT - Yambol begins with mastering the basics of programming by studying C++ programming language, and algorithms and data structures. For better understanding of the new abstract concepts they are presented with both pseudo code and a C++ source code. At the next stage of learning, the students are introduced to the basics of object-oriented programming using Java, and after that with Internet programming using Java as well. The created virtual lab for teaching in programming will cover only the basics of programming, and algorithms and data structures. Therefore, the matrix of the methods and forms of programming education in use at FTT - Yambol covers only these subjects in the education process. The specific character of the education here arises also from the goals that we have set for the education of engineering students, and this is also reflected in the scenarios included in VLTP and the characteristics of the VL as a learning tool. The matrix was developed taking into account the methods as given by Oganessian, but based on an analysis of the forms and methods that are in use at FTT - Yambol and the designed VLTP.

Form / Teaching method	EIMd	MdPgT	HMdT	MdPrT	MdMT
Lectures	+	+		+	
Practical exercises	+	+	+		
Coursework			+	+	+
Independent extracurricular individual work		+	+	+	+
Virtual laboratory	+	+	+	+	+

Teaching programming includes both mastering theoretical knowledge and gaining practical skills needed for describeing algorithms and data structures using a specific programming language, and creating programming code.

The theoretical knowledge is related to basic concepts in the field of programming. Most of these concepts are abstract and understanding them is related to overcoming certain difficulties in perceiving them, and the need for understanding and comprehending them by the students. The practical skills for describing algorithms require the development of a new kind of thinking – algorithmic thinking. This kind of thinking allows for the description of the sequence of actions that will be implemented by a computer and therefore this sequence has to be extremely precise, clear and formal.

The reproductive or explanatory-illustrative method (EIMd) is achieved using the following forms of education: lectures, practical exercises and the VLTP.

The traditional form of teaching theory is the lecture. It may consist of a verbal presentation and writing on a board, or using some form of presentation. In FTT - Yambol the lecturer uses a computer-generated presentation for the material, while also using with additional explanations, sometimes associated with writing on a board or creating graphic images - for example, the term "variable" may be presented as a box with a label (name of the variable), and content (the value of a variable); some algorithms can be illustrated with the help of everyday life examples; or by using with specific values of the variables for testing of an algorithm which we have previously we verbally described; or by using a flowchart diagram.

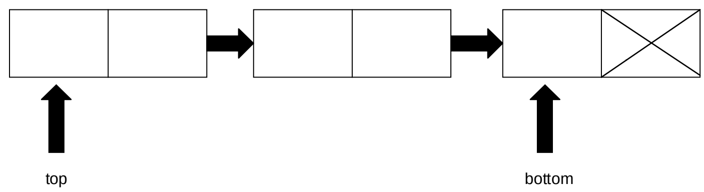
The traditional form for the development of practical skills for description of algorithms and data structures through a specific programming language are the practical exercises. They are carried out in computer labs and the students input, compile and execute (test) different source code in the relevant programming environment. The practical exercises held at FTT - Yambol all contain the following steps:

- A brief reminder of the theoretical material from the lecture
- Assigning a specific task based on the current and previously thought theory
- Understanding the task and reaching an algorithm for its solution (in this step the Heuristic method of teaching is fulfilled)
- Discussion of the algorithms that provided by the students (if any) or of an algorithm, which is proposed by the lecturer
- Implementation of any of the selected algorithms
- Entering of the programming code in the programming language environment
- Compiling and testing of the source code with control examples (in this step the heuristic method is used in determining the appropriate input data for tracking all the typical cases and analysis of the baseline data)
- Discussion of the code operator after operator for the purpose of its perception by the students who have failed to implement it by themselves.

These steps are not always enough for contemplating and understanding of the respective algorithm that is implemented by the EP. Adding operators to exit the program and printing out of the intermediate results of each step of the algorithm can improve the understanding of the process. Another way is by using presentations, in which the lecture, given by teacher, is provided in the presentation, i.e. more of the human perception systems (organs) are involved in the understanding the subject. The presentation can also use images of objects or processes from the real world in order to illustrate the appropriate algorithm or data structure.

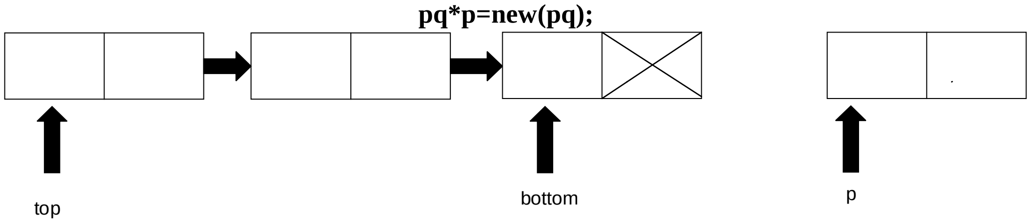
For example, for the easier perception of the program realization of the algorithm for adding a new element in the dynamic structure queue we can depict on the board how to change the structure for each operator.

First, we make a schematic representation of the queue, for example with three elements.

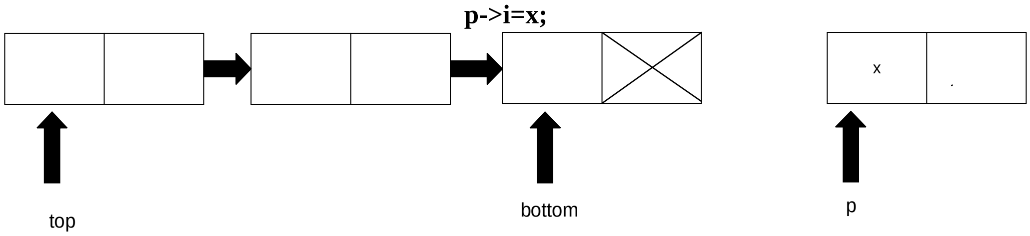


Then we begin to illustrate the code consistently operator after operator.

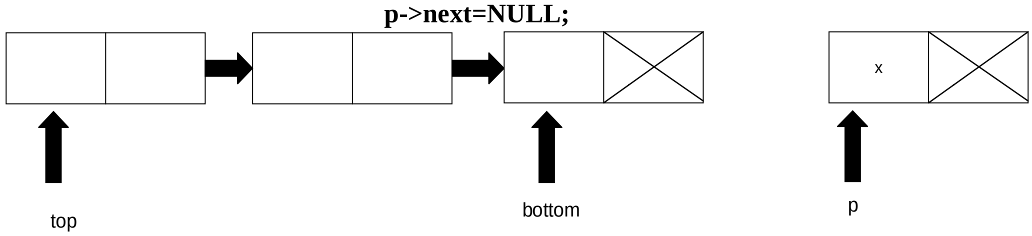
pq*p=new(pq);



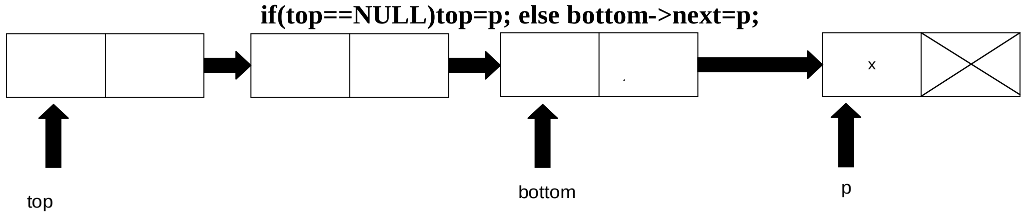
p->i=x;



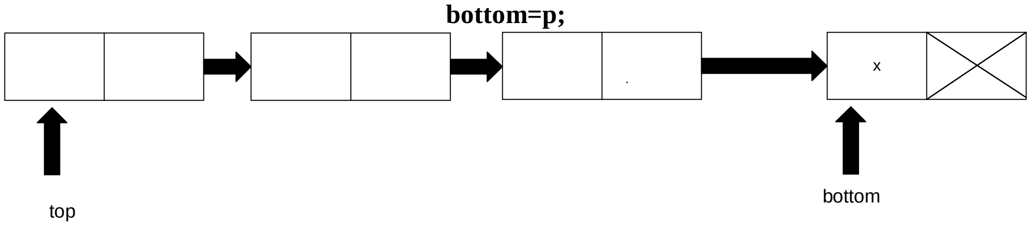
p->next=NULL;



if(top==NULL)top=p; else bottom->next=p;



bottom=p;



The virtual laboratory, is a non-traditional form of teaching programming, related to theoretical knowledge and practical skills. The explanatory-illustrative method is implemented through training modules when using the VLTP. The theoretical part includes verbal description and relevant illustrations of examples of life, which are analogical to the concept, operator or data structure. And using through educational materials provide further clarification to the simulation, to which they are related.

In the lectures we apply **the method of programmed learning** the following way -the students are given the opportunity to test for themselves an algorithm with a specific input data or to write a program code and test it in the relevant programming environment. In the **practical exercises** the lecturers use a multimedia projector to present a programming code, that, using joint efforts (through discussion between the lecturer and the students) is modified according to the terms of the new task and then it is tested in the relevant programming environment. Another traditional form related to the expansion of theoretical knowledge and improvement of the practical skills is the independent extracurricular work. The student can read and analyze the materials found in the corresponding e-learning course, or can use other sources of information, and solve problems to test the gained knowledge.

The method of programmed learning is achieve du sing different modules, arranged in two levels in the VLTP, which present interactive teaching units.

The Heuristic method of teaching is implemented in the practical exercises in which the students have to modify the code, presented in the presentation. Another traditional form related to the improvement of the practical skills is the coursework. To solve it, the student uses the theoretical knowledge acquired from the lectures and the practical skills gained from the exercises solved.

The students have to get to the idea which algorithms are suitable for solving the task by themselves and they have to select the operators which are to be implemented in the relevant source code. The analysis of available materials and solving the exercise problems that are part of independent extracurricular work also apply the heuristic method of teaching. This is achieved by selecting input data to perform simulations in order to cover various typical cases for the algorithm in question and also analysis of the results of its implementation using the VLTP.

The problematic method is applied in a lecture to justify the need for the introduction of interchangeable operator or another data structure. The lecturer provides the problem to be solved and ways for solving it, using the up-to-date knowledge, are sought. For example - the need to structure an array can be reached by giving a task that requires double-scan series of numbers and therefore cannot be achieved with a simple variable. The necessity to save the values of the elements in the series arises it this is done by using an array. The coursework is a problem for which the student himself must find a solution using the knowledge and skills acquired, during the lectures, and laboratories, and from materials like the e-learning platform and other sources. The independent extracurricular work is similar to the coursework in the way the gathered knowledge gathered is applied to solve problems. The problematic method in the VLTP is used in predicting the intermediate and output results from the simulation of an algorithm with a pre-selected input from the student.

The method of model training is implemented in the coursework using a predefined condition and solution of a sample task, which is used as a benchmark. During the independent extracurricular work, the student solves problems that are based on the provided materials on the subject and the knowledge and programming skills acquired up to that point. The **method of model training** while using the VLTP is achieved by going through all of the education stages in the laboratory - reading theory, case studies, examining algorithm code, data input, performing a simulation, solving a test and obtain a score. If the end result does not satisfy the student, he or she may again repeat some of the stages.

4 Conclusion

The verbal, visual and practical methods are appropriate in teaching programming. The first two methods are suitable for the presentation of the theoretical material. The visual and practical methods are suitable for the gaining practical skills for description of algorithms and data structures using specific program languages.

The methods of education, according to the classification of Oganessian (Explanatory-illustrative or Reproductive method, Method of programmed learning, Heuristic method of teaching, Method of problem training and Method of problem training) can be applied in teaching programming, not only using the traditional forms of education (lectures, practical exercises, coursework, independent extracurricular work), but also the VLTP. The VLTP may be use das an addition to e-learning, or can be used on its own as a form of distance learning.

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E-learning Course "Physical and Colloidal Chemistry" at the universities

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Abstract:

The report deals with the application of information, computer and communication technologies in the course "Physical and Colloid Chemistry". A review was made of experience in the creation of such courses for this academic subject in Bulgarian universities. Presented is an electronic course, created in the system for e-learning of faculty "Technics and Technologies" – Yambol, Bulgaria. Considered are the requirements of the labor market in the creation of curriculum for this discipline.

Keywords:e-Learning, Physical Chemistry and Colloidal Chemistry

1 The goal of the training in "Physical and Colloidal Chemistry"

The main objective of the course "Physical and Colloid Chemistry" of the students in "Food Technology" is to make student's knowledge of physicochemical foundations of real chemical processes involved in producing, purifying and fundamental kinetic, optical and electro kinetic properties of colloidal systems.

Students will learn about basic methods of obtaining colloidal systems, as well as some aerosols, suspensions, emulsions and foams.

The purpose of the paper is to present the specifics of developing a curriculum on "Physical and Colloid Chemistry", taking into account the requirement to provide an opportunity for lifelong learning and applying the European system of transfer and accumulation of credits (ECTS).

2 Preconditions for the effectiveness of training

The development of modern information technologies has led to the emergence of a new method of Studies "e-learning".The development of the modern computer, information and communication technologies contributes to the development of engineering and technology in various fields of science, education and production practices. In the field of education in the recent years have seen an increased interest in the use of remote sensing and electronic forms of learning (Pehlivanova and Ducheva, 2011).

E-learning meets the needs of the modern student of flexible learning available anytime, from anywhere.

The most extensive definition of e-learningis "Learning facilitated by the use of information and communication technologies (http://www.elearning.ac.uk/res ources/modelsreview).

To conduct e-learning we use modern information and communication technologies and the Internet.

E-learning can be achieved through attendance, remote or (most often) mixed form.

Usually behind websites offering e-learning stand systems management software, because professors can not develop alone the necessary Web - environment for this purpose. For the universities it would be laborious and inefficient to maintain multiple separate sites for different training courses. In the interest of professors and administrators of websites is Resources For Web - based courses to be maintained in common database to be easy to use, update, manage and integrate. . For these reasons many schools are looking to use complete software management systems training courses or develop a comprehensive system for the university. (Ivanov, 2008).

Such platforms for creating e-content, e-learning and distance learning are Moodle, D2L (Desire2Learn), Sakai, Acatar, Blackboard, which can be open source and distributed free of charge or are commercial. In the future Europe, built on the basis of the knowledge society and economy, strategies for lifelong learning are necessary to meet the challenges of competitiveness and the use of technology to improve social cohesion, equal opportunities and quality of life (The Bologna Process, 2020).

One of the requirements of the European System of Transfer and Accumulation System (ESTA) credits is to describe clearly the characteristics of the curriculum as defined goals, purpose, competencies and cross-curricular way to organize classes(ECTS Users' Guide, 2009).

Presented is created electronic course on "Physical and Colloid Chemistry", organized at the initiative of EU project (Project BG051PO001 - 3.1.07 - 0032) together with the faculty "Technics and Technology". His creation is a logical consequence of the rapid penetration of computers in all areas of life, the need for everyone to prepare in the scientific field with the funds offered by information and communication technologies (ICT). The application of these technologies create complex conditions for training and work (Nedeva at el., 2012).

ICT applications received avalanche development. In the universities are built e-learning systems on different platforms for learning.

The material on the subject "Physical and Colloid Chemistry" is codified in 45 hours of lectures and exercises in two semesters.

It is designed for students without prior special training in the field of physical chemistry. At the same time the developed course provides a good basic training, from which everyone can by your self continue improving their knowledge. The course can be beneficial for those who have already made their first steps in physical chemistry. Thehierarchy of the academic program was built based on the taxonomy of Marzano (Marzano, 2000) (Table 1).

The success of teaching depends on the proper construction of the content of the course. When creating a methodical units used approach from simple to complex in a combination of concrete to abstract (Shivacheva,at el., 2015), (Stoykova, 2015).

The absorption of new knowledge depends very much on the possibility of practical training - to experiment learned. Such a possibility is practical exercises that are described in the e-course and is conducted in the laboratory of the Department "Food Technologies" (FT).

The developed course on "Physical and Colloid Chemistry" has its drawbacks. For their removal are useful tests to evaluate students' knowledge and recommendations and comments from fellow teachers and students, which comply team developed an e-course.

Table 1 Hierarchy of the curriculum

Level	**Processes**
Obtaining of knowledge	Extract facts, sequences or procedures
Understanding of knowledge	Structuring the information by category; synthesis; Representation of information - organized by category.
Analysis of knowledge	Search for compliance; Classification;

	Analysis of errors; Summary; Specification.
Use of knowledge	Adoption of decisions Resolving problems Experimental work - conducting experiments; Research - requires the use of logical reasoning to analyze the results.

To match the needs of modern education, the basic tasks of teaching physical chemistry are:

- deepen, systematize and expand students' knowledge of physical and chemical processes and phenomena;
- developing cognitive interests, abstract and logical thinking in the process of forming concepts disclosure laws and causal relations;
- formation of skills for analysis and expression of relationships and regularities with mathematical equations and symbols;
- formation activity, accuracy and flexibility in the choice of parameter values for conducting technological processes;
- forming habits and mentality to participate in process control;
    - Knowledge and skills to build competencies:
- physicochemical characterization and selection of parameters for solving environmental problems and managing technological regime;
- derive mathematical relationships and their transformation under the characterization of chemical processes;
- Work with schemes, diagrams, tables and other sources of information for the analysis and prediction of physicochemical processes;
- The development of e-learning courses using different platforms with open access, of which the most popular of them are Moodle ATutor, Claroline, Ilias, Sakai, dotLRN, Fle3.

The capabilities of Moodle, as a system for e-learning include the following components and features:

- to enter and derecognized students;
- publish any text and illustrative material;
- seek feedback through surveys;
- prepare examination papers;
- give jobs exchange projects;
- assessment tools;
- forums;
- messaging;
- personal e-mail.

Lectures "Physical and Colloid Chemistry" are illustrated with slides on given topics. After each subject to check students' knowledge were drawn up control tests (Figure 1). The training materials are available for specific dates, in order to respect the sequence of the curriculum. Users of the course are free to control access to the system and how they navigate it.

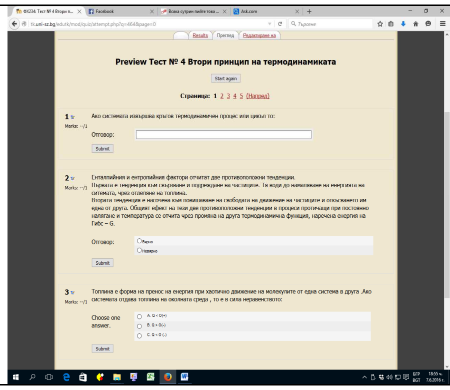
E-learning is available at any time when the consumer is willing to learn or find answers to specific questions. The time to absorb specific knowledge is not limited.

The course on "Physical and Colloid Chemistry" ensures effective integration between e-learning with traditional education. For example, the current assessment of lectures successfully combined with online tests, allowing early to detect shortcomings in the preparation of the student. The e-learning method, generates interest in students on the main issues of chemical thermodynamics and electrochemistry, including videos of some phenomena , which causes students in separate explanations of phenomena observed.

An important criterion for the effectiveness of the training is the correlation of classes on discipline studied in "Food Technology" with other Bulgarian universities.

In addition to faculty "Thecnics and Technology" at the University of Thrace, the course "Physical and Colloid Chemistry" is performed in the following universities in Bulgaria: University of Food Technologies (UFT) – Plovdiv, University "Prof. Zlatarov "Burgas, Russe University" Angel Kanchev "affiliate - Razgrad.Workload of classes "Physical and Colloid Chemistry" for degree (ACS) "Bachelor" for the 2015/2016 year are given in

a) Main page



b) page with tests

Fig.1. Website of the e-course on "Physical Chemistry»

Table 2 Hours of classes "Physical and Colloid Chemistry" for degree "Bachelor"

University	workload	
	lectures	exercises
Faculty "Technics and Technology" - Yambol	45	45
University of Food Technologies (UFT) – Plovdiv	45	60
University "Prof. Zlatarov " - Burgas	60	60
Russe University" Angel Kanchev "affiliate - Razgrad	45	60

The comparative analysis shows that there is a very big similarity in the classes of the discipline with other universities. This is due to several factors such as the presence a few years ago a unified state requirements, close contacts and cooperation between teachers from different universities.

3 Conclusions

Practical use of established program "Physical and Colloid Chemistry" at the Faculty "Technics and Technology" - Yambol, allows to increase student motivation for learning, skills and enhancing professional competencies of graduates.

The comparative analysis with the experience of other universities in teaching this discipline showed that in this stage an important prerequisite for efficiency is the compliance of the material with the requirements of the labor market, which is priority direction in the EU.

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Students preferences on the types and activities in e- and Blended Learning

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Abstract

In the report, we examined definitions discussed in earlier studies by different authors and projects. In the defining the blended courses in the classroom we focus on various activities and tasks that can be performed online, synchronous and asynchronous to improve the effectiveness of training and to increase the autonomy of the students. The accent of the report is placed on the needs of different groups of students, according to the level of preparation, motivation, and ability to work with information technology. The survey was conducted through questionnaires and it is covered students bachelor's degree, specialty Auto transport and Agricultural Technique I and III course, regular and part-time training. This enables us to make a comparative analysis of the attitudes and views of students entering the faculty and those who already have more experience to work in Blended and e-learning.

Keywords: activities, e- and blended learning

1 Introduction

In the early 21-st century is observed strong interest in research and development on the problems of e-learning and "digitalization" of secondary and higher education. Despite the discussions, a number of researchers coalesce around the understanding that e-learning includes all forms of diversification of the teaching through digital media, including blended learning. (Euler, D. & Seufert, S. 2005; Kleimann, B. & Wannemacher, K. 2005; Stratmann, J. & Kerres, M. 2008; Zellweger, F. 2007; Arnold P., Prey G. & Wortmann D. 2015) We accept the opinion of German scientists (Arnold P., Prey G. & Wortmann D. 2015) who identify several key areas for implementation of digitization in education in universities in different areas: teaching and learning, management the education, research and more.

2 Theoretical background

In preparing the report, we examined definitions discussed in earlier studies by different authors and projects. For the purpose of the study we use the summary definitions for electronic, distance and blended learning conducted in the article of John Sener. We assume that they will be further specified and developed with the development of various pedagogical technologies and forms of education in universities. (Sener J., 2015)

In 2012, Frank Mayadas and Gary Miller published a series of definitions for the formulation of a common understanding which have been updated. They were designed for a better understanding of various types of e-learning in higher education. There are proposed standard models for effective exchange of information for e-learning at the individual level and curriculum. Key elements of these definitions are models of instruction, time and flexibility. (Mayadas Fr., Miller G., Sener J. 2015) In formulating definitions for base are used various psychological theories of learning. Most often researchers refer to cognitivism, constructivism and connectivism. The representatives of the *Cognitivism* consider learning as a process of information processing in the human brain by using appropriate methods and procedures for detection of correct answers from students. Historically, the development of *constructivism* during the 20th century have contributed Jean Piaget, Lev Vygotsky, Jerome Bruner, Ernst von Glaserfeld and have evolved various fields such as cognitive constructivism, social constructivism, radical constructivism. Regardless of the viewpoint, representatives of constructivism explain the learning as an active process in which knowledge is related to their own knowledge and personal experience of learners in complex real-life situations. The preliminary personal knowledge is unique and therefore each student has their own needs, objectives and context of learning. Nowadays great popularity received *social constructivism* with social character and joint activities within the e-learning as one of the main core competencies of 21c., which are associated with teamwork in problems solving. The concept of the representatives of *connectivism* comes close to social constructivism by considering the learning process and learning not only as an individual process, but also as a learning in organization or in a network structures. The concept emphasizes the importance of detection and evaluation of information; such efforts are aimed at forming meta-skills as a prerequisite for successful learning.

There were developed different definitions and classifications of e-learning. The summarized characteristics of e-learning (Sperl Al., Frenger R., 2014) include the development of educational content using digital media platform through e-learning. According to us and these authors e-learning is characterized by spatial and temporal independence in a continuous Internet access. The feedback, control and assessment through digital systems are included as a component of e-learning, synchronous or asynchronous monitoring of the learning process of the students. Within the electronic courses professors can use a rich set of tools that includes web conferencing systems, Blog, Chat, Dropbox, E-Book, E-Portfolio, Forum, Dictionary and more. The web-based learning in some definitions is seen as a training program that can be accessed via the Internet and serves the purpose of self-education and according the possibilities of communication can be synchronously and asynchronously. We accept the proposed variant of classification on the course level (course in the classroom, synchronously distributed courses enhanced Web courses, hybrid or blended courses in the classroom, online blended courses) and definitions according to the syllabus (course in the classroom combined program, multi -programme combined program and online program). (Kerres, 2012г.)

The analysis of the proposed definitions of course level shows that currently the faculty applied in practice mainly online courses in which helps auditory activity without reducing the number of "face to face" training hours.(Mayadas Fr., Miller G., Sener J. 2015). In the e-learning in the Faculty are included "courses in the classroom", which use software simulations, laboratories, software design for art or engineering applications, but mostly at the scheduled time of auditorium sessions. A part of Web-based courses are insufficiently flexible in terms of time not withstanding that the pre-recorded lectures and related activities can be viewed later.

In the our earlier studies, and now in defining the blended courses in the classroom we focus not on the percentage distribution of the time but rather on various activities and tasks that can be performed online, synchronous and asynchronous to improve the effectiveness of training and to increase the autonomy of the students. The blended courses are suitable for students regular and part-time training and are attractive because most of them work, but to be competitive in the labour market should raise their educational level and professional qualifications.

There is interest and efforts to be developed flexible courses that offer a greater Option to choose multiple modes of delivery. From the standpoint of the theory of education in the development of e-learning, we can include and combine different components in a different sequence. The variants include combinations of sequential and online auditorium work (online content, new learning content and deepening of content during the auditorium work, online content, and so on.). There are variants in which after the online session is conducted and several sessions of attendance (for new content, to deepen knowledge and feedback), etc. Another variation that we think is very suitable includes online content development, online discussions and works, followed by tests for self-evaluation. During the classes is carried out in-depth analysis of the results, the reasons for the gaps to supplement online and reinforce "face to face". (Sperl Al., Frenger R., 2014).

The accent of the report is placed on the ability to meet the needs of different groups of students, delineate specific groups according to the level of preparation, motivation, and ability to work with information technology. To improve the flexibility of the learning process, it is necessary to introduce specific to the professional students training forms through which training meets the requirements of the business.

Through various projects at university and faculty level in recent years within Trakya University and Faculty "Technics and Technology" - Yambol we work for the development of philosophical and pedagogical framework for the digitization of education, to improve its quality. It is created conditions for developing of learning culture of the students, developing e-learning courses, publication of electronic books and manuals and more. In our previous research and other researchers emphasizing the importance of digitalization to increase: the effectiveness of the training; quality in the teaching; access to a various training courses; job offers, etc. The results of our previous studies suggest that the attitude and willingness of students and lecturers are not for an overall exchange of traditional training, but for flexible training that complements the work in the classroom. One of the objectives of the joint training is to improve the quality of education by enhancing teaching, support of independent activity of students to increase their motivation to learn and attracting and retaining students in the faculty. The longstanding studies within the university and faculty consider and seek a balance between traditional and e-learning, digitization of higher education by combining different approaches and teaching technologies. With the support of academic leadership were held a number of training courses for the introduction of innovative pedagogical technologies enables the initiative of teachers and at the same time provides support.

Design of the study

The survey was conducted through questionnaires - some of the questions have closed answers and others have responded that require ranking by degree of agreement/ disagreement with using a 4-point scale. The inquiries are part of the study that will cover students bachelor's degree from I to IV course of all specialties. At the initial stage, the study was conducted with students, specialty Auto transport and Agricultural Technique I and III course, regular and part-time training. This enables us to make a comparative analysis of the attitudes and views of the students entering the faculty and those who already have more experience to work in Blended and e-learning.

Results and Discussion

At this stage in the study were included 50 students, being distributed in a three age groups according to their belonging to different generations by the classification of Mark MakKrindal related to the development and using of information and communication technology and the evolution of humanity. (McCrindle, M., 2006) Data analysis shows that currently more than half of the students belong to Y-generation accustomed to technology and feel themselves comfortable in the digital environment. The training of these students need to focus on personal learning environment to provide them with the opportunity to build knowledge through WEB services, as well as group work and continuous collaboration.

Only 6% belong to the Z-generation, called "the key to the revolution in communication." The majority of the representatives of these two generations are a factor that contributes to the use of modern pedagogical technologies in training.

The high percentage representatives of X-generation are due to the fact that part-time training students are working. They are a bridge between the older and younger generations and many of them use computers and technology in the professional realization.

The results according to gender the surveyed are reasonable as students of Auto transport and Agricultural Technique are mostly men (86%). Once again we emphasize that the majority of representatives both genders are of the generation of "digital natives", which facilitates the possibility of working in an electronic environment and increasing number of mixed electronic and online courses.

Judging from the theoretical concept of the components of e- and blended learning, we can say that the ability to manage the process of teaching and learning, development and supply of content, variety of tasks online, the possibilities for synchronous and asynchronous communication and evaluation in e- and blended courses are suitable for students regular and part-time training, are attractive because most of them work. Thus, students are provided with greater opportunity for individualisation and differentiation, according to the needs, interests, motivation and personal time.

The majority of students in specialty „Auto transport and Agricultural Technique“ simultaneously with Bachelor's degree receive additional qualification for instructors, training drivers and teachers in secondary vocational schools. This increases motivation and interest in acquiring knowledge, skills and experience to work in a virtual environment, as these skills are essential and necessary for the development of pedagogical skills for teaching children and adults. According to regulations, preparation of drivers and application of theoretical and practical examination is carried out by technical means and online.

In Scorecard teacher are set the fields of evaluation and performance assessment. By the indicators for teaching and assessment activities and competencies of pupils / students, the students - future teachers / instructors will have to create its own set of teaching strategies and resources for developing individual potential of each student, to improve the effectiveness of evaluation, and they will work mainly with representatives of the generation Z and Alpha

In the development of e- and blended learning courses the professors take into account the peculiarities of the learning styles of Representatives for Z-generation that will prevail over the next few years. The learning process of Z-generation should be well structured to provide continuous "feedback" with learners teaching content to be supported by bright visual information to highlight key moments in content and after achieving a goal to determine the next one. The information should not be large terms of volume and through conversations and discussions to stimulate the forebrain, which is associated with decision-making and communication provides a dynamic learning process and stimulates memory.

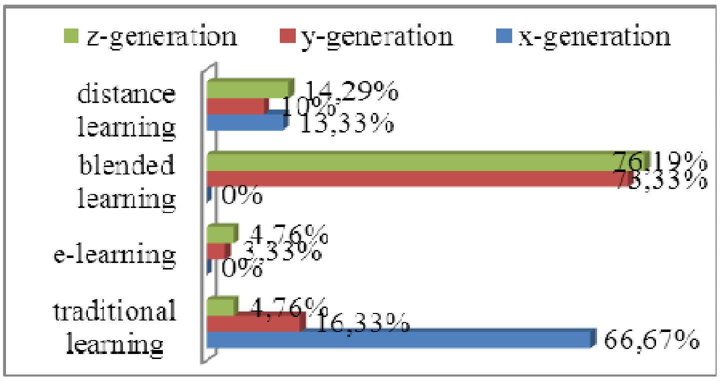

Figure 6 Preferences students the type of training (distribution by generation)

Particular interest is the analysis of data on preferences forward across generations of students to the forms of training. Are confirmed in studies by other researchers and our previous studies that even representatives of the Y and Z generations prefer the options of blended learning, a combination of different forms of training, teaching materials, teaching methods and the use of the interaction of traditional classroom lessons supported with computer training (individually or through collaborative learning). The blended courses contribute to enhancing interaction in learning, to improve motivation and success, and to develop the skills to solve problems in groups and solve the task team. In modern times because of the complexity and interdisciplinary of real industrial and life problems require construction of knowledge through active research, personal experience and cooperation with other learners.

Through statistical analysis and searching of connection between members of different generations and preferences of different types of training, we received a *strong correlation (G = 0.88764)* which once again confirms that members of Generation X are accustomed to the style of learning and work associated with traditional training, although they meet the digital revolution and in order to adapt to it they have to learn to work with digital technology. Logically and understandable that representatives of the Z-generation receives a *negative medium dependence (G= -0.678322)* for traditional training as family, social and media environment formed in them a different style of perceiving information and learning related to digital technologies. The interpretation of the correlation between the representatives of the Y-generation and their preferences for learning statistics show *medium dependence (G = 0.466667)* with blending of elements of traditional and e-learning.

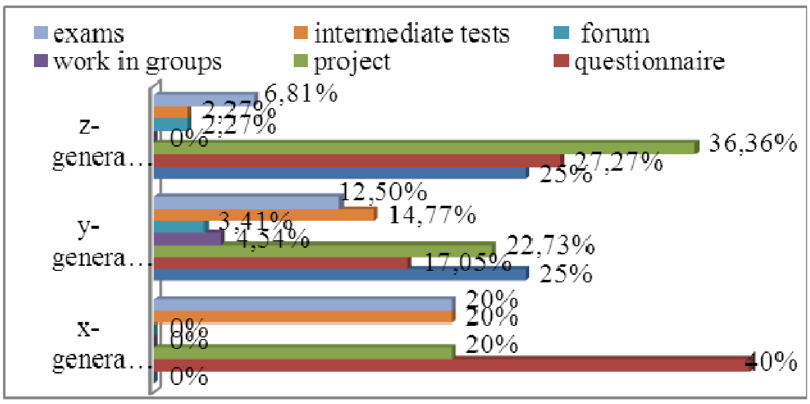

Figure 7 Activities of the students in blended and e-courses

The analysis of the survey results regarding the type of activities and tasks that professors instruct the students in e- and blended courses, show that representatives of the X generation determined that most often is offered questionnaires or tests, according y generation - uploading a certain documents within a time limit, while Z - writing projects, developing presentations. Closer in value are the results for the implementation of monitoring and feedback through intermediate tests and exams in an electronic environment, which establish the final results in acquiring knowledge and developing skills in students - representatives of the X- and Z-generations.

We would like to emphasize that still lack some opportunities and tasks for group work, posting in forums those develop communication skills, as these skills are in the group of core competencies for professionals of the 21st century. Our conclusion from the survey results is supported by data for the evaluation the skills of students from the international study PISA 2013, PISA 2015 that students faced difficulties when solving problems and in solving problems as a team.

Logically and necessary for the development of e- and blended courses to analyse and include different types of tasks, determine their ranking and priority according to several key factors: significance the required frequency of setting and solving, the degree of difficulty, the experience of the students in solving a particular type of task. It is very important through the activities and tasks in e- and blended learning to seek not only the application of information but also ways of finding, processing and critical personal attitude and skills transfer into real industrial and life situations.

The e- and blended courses provide good opportunities for a develop skills to solve problems in a team as interdisciplinary skills, but still according to the students these types of activities and tasks that develop them are less represented in their training or completely missing.

Only the representatives of the surveyed Z-Generation are specified work group and solving problems as a variant of activity. These shows that even in the possibilities of digitalization of the training are not used opportunities for development of another key competence "teamwork" which is essential when working in multidisciplinary teams to solve complex interdisciplinary problems. In developing and including of a variety of tasks is necessary to focus on the tasks that form a shared understanding of the problem from the group competences for appropriate actions to solve the problem and maintaining a group/team. (PISA 2012)

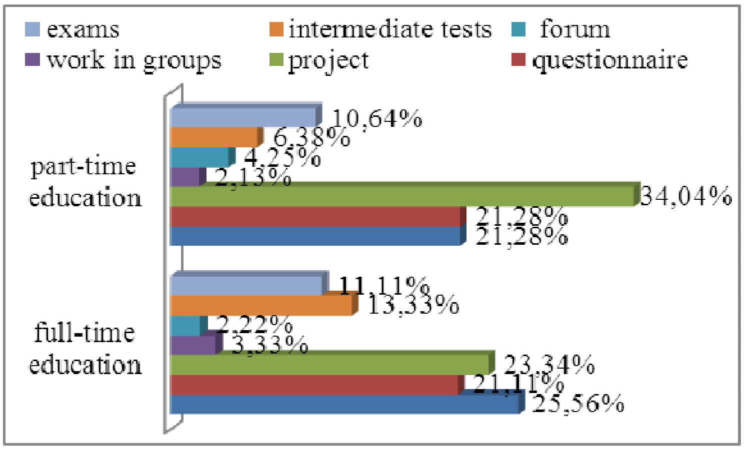

Figure 8 Activities of the students in blended and e-courses (distribution according to form of training)

Analysis of the results depending on the form of training of the surveyed students shows that part-time students are assigned more projects and presentations, as well as work in forums, which is logical given that the auditorium employment and teaching „face to face“ is concentrated in a short time. Close in value are the data for carrying out of the final evaluation in e-environment in all surveyed students because that part of the examinations for a regular and for a part time education are in electronic format, but are held in the faculty. And these results show a bad trend on the opportunities for interaction and group/team working, while at percentage ratio are less to the students in part-time education. In the future development of e- and blended courses should be used more widely and completely possibilities of forming groups not only by specialty, but also according to the given problems and tasks in order to stimulate the development of skills to solve a group tasks and achievement of group aims through collaborative work, which is close to solving a real industrial and life problems and situations. In both groups of surveyed students as a form of activity and task prevails uploading and work with documents, which are related to improving of organizational skills and discipline, but not as with processing and application of information and decision making.

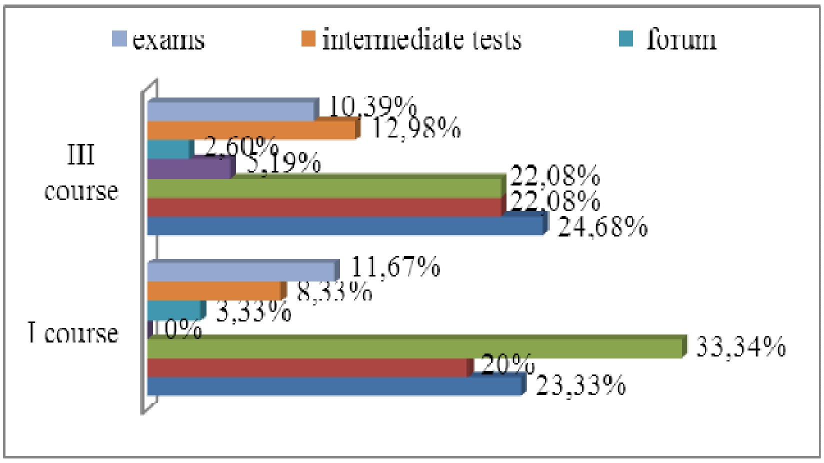

Figure 9 Activities of the students in blended and e-courses (distribution according to the course of study)

As a result of efforts to expand the share of e- and blended courses in the faculty and qualification of the academic staff to work in e-learning environment, analysis of the results of students first and third year show a positive trend in the group work in third year. We can interpret the result that the focus of the work at the Faculty is routed to the skills for teamwork. The results for posting in forums are higher for the freshmen, but they probably do not mean work in forums directly related to the training. The implementation of tasks related to the development of presentations and projects in percentage is higher for the freshmen, because it is assumed that some of them have studied informatics and information technology in secondary education and have better basic skills to develop presentations. Within the framework of e- and blended courses for surveyed students from third year, more often are awarded for completing the intermediate tests than the final exams. This trend is positive as it performs a basic principle in training for carrying out continuous feedback between students and lecturers which leads to increasing motivation, reinforcement of knowledge and skills for a self-reflection and formation of objective self-assessment.

Conclusions

As a result of the previous analyzes of the study can be summarized:

- the results suggest that the attitude and willingness of students and lecturers are for flexible training that complements the work in the classroom;
- at the faculty level, the academic staff works to meet the needs of different generation groups of students, to introduce specific to the students training forms through which training meets the requirements of the business;
- more than half of the researched belong to Y-generation and their training must be focused on modern pedagogical technologies, creating of personal learning environment to provide them with the opportunity to build knowledge through WEB services, as well as group work and continuous collaboration;
- the ability to manage the process of teaching and learning, development and supply of content, variety of tasks online, communication and evaluation in e- and blended courses are suitable and attractive for students regular and part-time training;
- the blended courses contribute for solving of the complex, interdisciplinary and real industrial and life problems require construction of knowledge through active research, personal experience and cooperation with other learners;

In the future at the Faculty level must be working on expanding of the students teamwork, on increasing of activity in educational forums in order to develop communication skills and high social skills such as management and teamwork - key competencies for modern professionals

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An analysis of the assessment of students on the features and functions of Moodle

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Abstract

Improved capabilities and practical enhanced functions of Moodle 2.8 makes it a preferred platform for developing blended and e-learning courses as it improve the quality of education. The lecturers in the Faculty of Technics and Technologies - Yambol prefer to use Moodle, because of the easy access a variety of functions as well as the wishes and interest of students to: selection and organization of learning resources and activities, evaluation of its achievements and communication. Students note and prefer the capabilities of Moodle to develop educational content (e-lectures, materials, less vocabularies), asynchronous forms of communication (forums, email, etc.) and implementation of feedback in the evaluation of their activities and achievements. The surveyed Students have not indicated preference for a collaboration, teamwork and mutual evaluation, although the respondents were given the opportunity to supplement.

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Keywords: Moodle activities, Moodle functions, students preference, design of courses

1 Introduction

Professors and researchers in universities and faculties prefer to apply Moodle as it is free to download and changing Learning Management System (LMS), which is used in the development of various projects, related to the development of e- and blended courses. The name Modular Object-Oriented Dynamic Learning Environment highlights the capabilities of the platform which allows the use and adding additional functions and modules that are divided into categories, related to the form of courses, educational activities, information panels, reports, filters of the content, assessment, users' management, management of the information sources and others (Djambazov, V. 2012). These technological advantages to maintaining it's over one hundred (110) language versions contribute to a broad applications. In the works of various scientists' as advantage are highlighted opportunities for easy access, various forms of cooperation, individual activities as well as built-in tools for maintenance of resources. Of particular importance are expanded tools for continuous monitoring and implementation of feedback that contribute to the implementation of personality- oriented approach in teaching and differentiation of content and activities. Thus professors can observe process and the type of learning and to provide systemic support for individual development of students. The application of Moodle is expanding not only in the field of higher education but also in various companies, non-profit organizations for the recurrent training and qualification of their employees, which is linked to lifelong learning and increase effectiveness of the work.

2 Theoretical Background

In the presented report shall be discussed the involved by the professors and the desired by the students functions and features of Moodle 2.8. This is a better version of Moodle, used in the

Faculty and which has practical enhanced features that will give more opportunities of the lecturers to improve the development of blended and e-learning. The enhanced capability for assessing the achievements, forums, analyses and general usability of all devices is connected to improving the quality of education. Here we would like to emphasize on the potential of universities and professors to use Moodle for interactive online training courses in which students interactions can be tracked, and the responses can be evaluated.

We have used and a comparative analysis which was made between LAMS and Moodle system for management of the training (Moodle community), through which the professors can design and deliver online an educational experience and the opportunity to develop high-tech-based designer skills in the training of students. (Bower, M., Wittmann, M., 2011)

For the analysis of the survey results we accept a brief and summarized definition and characteristics of Moodle formulated by D. Denev (Denev, D., 2009) as:

• Open source system for e-learning, written in PHP;

• Course Management System (CMS), specifically designed to create quality online courses from lecturers;

• Learning Management Systems (LMS)

• Virtual Learning Environments (VLE).

Moodle's capabilities as a system for e-learning include the following components and functions: to record and derecognised students; to publish any text and illustrative materials; to seek feedback through surveys; to prepare examination materials; give assignments of the course projects; assessment tools; forums; messaging; own e-mail.

The main functions that Moodle provides are interactive online services: the creation, presentation, management and use of training content and features for tracking, analysing and reporting results. It is easy to use and has a wide range of cooperation, individual activities and tools to maintenance of the resources that are integrated. The advanced monitoring tools make it possible to take into account the individual support of each student. Everything listed here gives us grounds to say that the platform contains a set of modules, which makes it flexible at all levels an internal system for renovation and restoration, universal database as is paid particular attention to security at all levels.

For the purpose of our study are relevant capabilities of Moodle, for the interaction between lecturers - students and students - students for active learning, critical reflection, which are related to the theoretical foundations of pedagogy of social constructivism. It emphasizes the fact that this system is best suited for online courses, as well as for mixed as the developed courses in the Faculty. From a pedagogical perspective, Moodle is suitable for pre-acquaint students with the description of each course, with selective search by keyword, as courses are arranged by category. This capability facilitates the orientation and the choice of the course by students as support them even though the platform can support a large number of courses. It provides students the opportunity to shorten the time period in search of the necessary information, despite the large terms of volume and diversity learning content and number of e- and blended courses. In order to ensure updated information and provide the latest theories and trends in the science contributes integrated editor that allows editing the majority text elements.

Of particular interest for our study of the pedagogical point of view represents the structure of the Moodle interface that facilitates the work of students, because professors can design management of the learning process, actively to involve students in revealing the secrets of science, while at the centre are the activities. The activities are at the forefront and everything serves to support what students should be able to do. This allows for a clear and understandable model of attraction. The professors have the opportunity to provide and additional tasks that support the development of competence of the students. Using the capabilities of Moodle, professors can develop not only knowledge and skills but also values, attitudes and motives; they can model appropriate behaviour into specific situations. In the development of e- and blended courses can be create conditions for developing students' ability to coping successfully of the problems and tasks that arise in various business and life situations. Researchers and practitioners emphasize that the capabilities of Moodle are particularly good when it comes to developing asynchronous, problem-based workshops that require cooperative learning. From a practical standpoint the linear interface requires a longer period of time to work "face-to-face", but the learning process is supported with visualization, which is more attractive and acceptable for the students.

3 Design of the study

The survey was conducted through questionnaires as a part of the questions are answered with closed and others have responded that require ranking by degree of agreement/disagreement with using a 4-point scale. The inquiries are part of the study that will cover students from bachelor's degree from I to IV course of all majors. At the initial stage the study was conducted with students majoring Auto transport and Agricultural Technique I and III course, regular and part-time education. This enables us to make a comparative analysis of the attitudes and views of students entering the faculty and those who already have more experience to work in a blended and e-learning. The majority of the surveyed students were male (86%). The distribution by gender and belonging to a particular generation shows that 100% of the surveyed students are men - representatives' of X-Generation, while men, representatives of Z - generation are 90.48%. Relatively, highest percentage of women in the surveyed students from the Y- generation, followed by Generation Z.

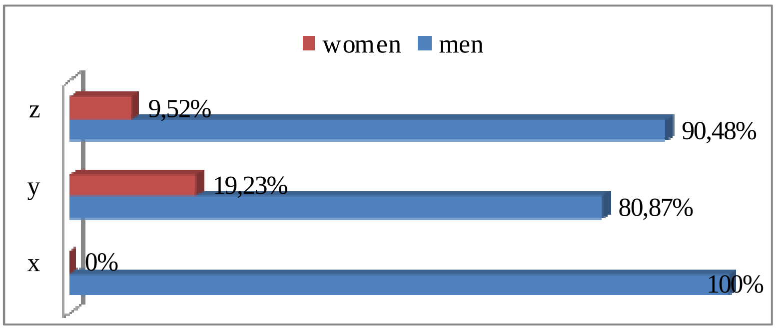

Figure 1 *Distribution of surveyed students by gender and generation*

4 Results and discussion

In the created blended training courses for students in the Faculty of Technics and Technologies of Trakia University are used the capabilities of the basic functions of the platform, but the study of the students, they indicated their preference to specific components of functions. In the survey, the students indicated that most frequently professors and students are using components of the functions "Managing Learning Content", "Examination and evaluation of achievements" and "Communication". From the obtained data, we can conclude that the surveyed students are often involved and prefer activities of these three functions.

In a previous report we indicated what the preferences of the students are to a various activities. We would like to note that an activity that the students perform within the blended and e-courses covers several elements or functions of the platform. Despite the possibilities of the

Moodle, the focus in designing the materials for e- and blended courses should be directed more on the experience that will gain the students, rather than on the resources that can be used and should be read, this trend is less pronounced.

The data analysis shows that the surveyed students, representatives of various digital generations, the highest is the percentage of those who use e- lectures, followed by those who use the tests, upload various materials and documents and questionnaires. A part of the professors improve the e- and blended courses using the functions and features for active interaction with students and between members of the study groups, their involvement in assignment of roles and rights as well as monitoring of personal educational progress. In the development of training courses planned activities include several functions of Moodle. Regardless of experience, and the positive trend in the development of e- and blended courses in Moodle, the students are not included enough active presentation, opposition and critical revision of educational resources. Most often it is assigned with developing and completing the dictionaries included in the course or comparative analysis of different definitions of concepts from different perspectives. In the development of some of the tests the students can make suggestions for the formulation of the problems and tasks, but traditionally they are developed and proposed by the professors. It is relatively low the percentage of surveyed students (only representatives of the Y- and Z-generations), who indicate that in the e- and blended learning they use forums and their opportunities that increase skills for interaction, increase critical thinking and self-dependence of the learners.

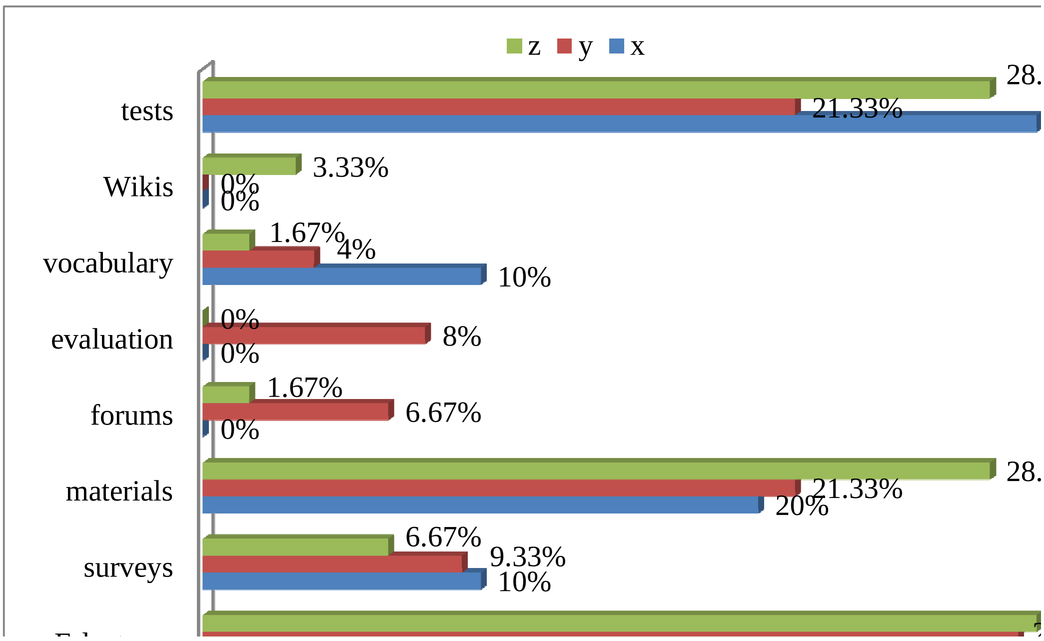

Figure 2 *Which features of Moodle students use most often*

Ours researches and our observations suggest that the development of e- or blended courses require the professor to show creativity, to consider and added a variety of resources and activities for students to motivate them by using their expertise and experiences to enable students to complete the course successfully._As the most easy and affordable variant with a widespread design of courses is to contain a set of resources/documents that are easily removed, tests for self and final examination upon completion of training. All professors who offer blended and e-learning, offer lectures and notes on issues of educational content, since they can focus on specific and complex problems in learning that students meet certain difficulties, but also to express their opinion and attitude on these issues. The proposed resources in the form of lectures, notes, etc. support various independent activities of students and support their preparation for the final test.

The analysis of the data obtained on the question "Which of the features of Moodle you use most often?", students have indicated again as a first preference e- lectures, tests, uploading and use of documents and materials, inquiries and forums. Since it is more complicated and time consuming, the development of a wide range of tasks requiring independent and critical thinking skills for teamwork through information exchange and interaction between students, the instructor of the course and the rest of the group, i. e. offering activities that include some of the features of the platform are less used. The two main types of activities, that by their nature may be synchronous and asynchronous, support not only the motivation and students learning, but also can enrich the main sources of information and learning content. Video-Conference connections aren't used in the training courses, rather they are used by professors in the participation in projects and scientific conferences, but they are very limited for the moment. In e- and blended courses often are included options for viewing video, listening to audio, presentations, and communication through e-mails. Despite the personal experience of the students to participate in Wiki or blogs, in blended and e-learning, lecturers often do not provide, and students do not actively use the opportunities to participate in discussion forums. The expansion of these activities and the use of the communication functions of the system will contribute to increasing the independent cognitive activity; will develop critical thinking and the development of higher levels of knowledge among the students.

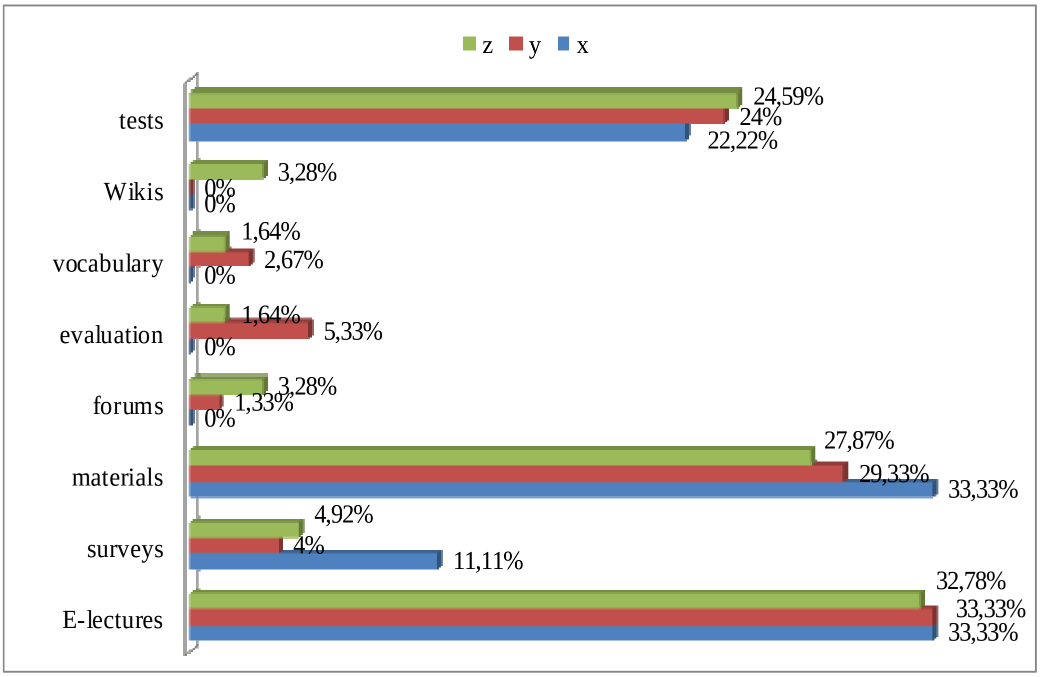

Figure 3 *Which features of Moodle are most useful for students*

Both graphs (Figures 3 and 4) show that the theoretical pedagogical basis on which are developed e- and blended courses and pedagogical style and the preparation of lecturers to work in a virtual environment, influence of the students learning and using of the possibilities of open platforms.

Therefore our opinion and that of other researchers is that the training of professors for the development of e- and blended learning courses should be a continuous process throughout the whole professional career. Despite the projects and the initial training for designing of e-courses, some professors who are successful in the traditional classroom, have difficulties of turning these materials into effective online/blended courses. A very important aspect is how the professors can use the platform for structuring of learning content and how to present the instructions, so as to ensure appropriate educational environment for the development of positive learning motivation of the students, and to enrich their professional and social experience. Our experience shows that designing of an effective e- or blended courses and high-quality online materials, is very time-consuming. Still as a disadvantage we can mention that in the adaptation of traditional courses as an e-/blended courses prevail the functions associated with educational content (Lectures and notes, presentations). In all works is meeting the possibility of self-examination and evaluation, but almost no opportunity for mutual assessment of the students in the group.

Often due to insufficient application of the possibilities for communication in the Moodle platform, there is no or is very limited the interaction and partnership between professor and student, student - students and others. The development of the design of the training content and training management, tracking and analysing of the students' results should be a continuous process that reflects the needs and interests of students, which stimulates the independent learning.

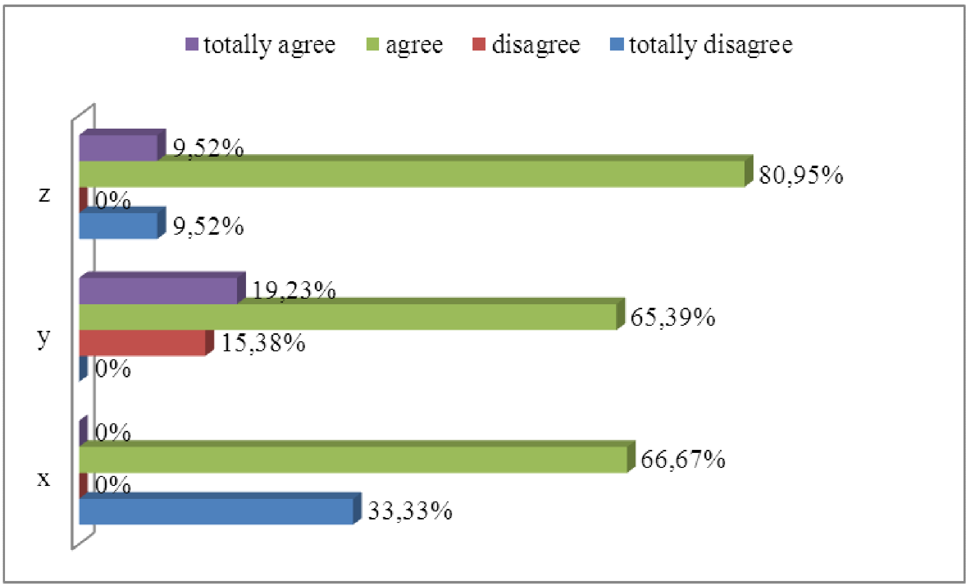

Figure 4 *Preparation of professors for communication in an environment of e- and blended learning (students opinion)*

The analysis of the survey data indicates that relatively highest percentage of representatives of Z-generation who have expressed the opinion, that professors are prepared to communicate into e- and blended educational environment. Similar are the results with representatives of the other two generations - Y and X, who accept that their professors are prepared and able to work in a virtual learning environment. Interesting is the fact that when analysing the results the highest is the percentage of representatives of the X-generation who need use computers and technology in the implementation of the profession and who don't accept that professors are prepared to communicate in an e-learning environment. I.e. viewpoint of the part of the respondents confirmed that the preparation of professors for e-learning should be a continuous process and there is necessity of continuous improvement.

5 Conclusions

- There is a trend for greater use of Moodle for e- and blended learning courses.
- Less are used features and functions of Moodle in the design of courses, as the materials are aimed at developing the expertise and competence of the students, not only on the use of resources and reading of the materials.
- It is necessary to provide opportunities to continuously improvement of the preparation of professors in a virtual learning environment.
- The focus in the design of e- and blended courses to focus on the opportunities for communication, interaction and partnership between professor and student, student - students and professors respect the needs and interests of students, which encourages the independent learning.
- Professors work in Moodle and use the possibility in designing activities that support not only the acquiring knowledge and skills but also build the values, attitudes and motives and modelling appropriate behaviour in specific situations.

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Study of unauthorized use of e-resources and e-services during exams from students

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Abstract

A study conducted among students aiming to establish the extent of unauthorized use of e-resources and e-services during the exam. Check massiveness of this phenomenon and to find links between certain success, attending classes and more.

Keywords: e-learning, e-resources, e-services

1 Introduction

According to the European Commission e-learning is defined as "Learner-oriented approach to the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration". The benefits of its development are indisputable. It changes the way of teaching. Raise standards, provides opportunities for expansion of lifelong learning, customizing and creating conditions to enrich the learning experience and the quality of education. Of course, it can not replace professors and their routine and experience, but with traditional methods can enhance the quality of teaching.

E-learning, web-based training, online training and distance learning are widely used nowadays. Often too high hopes are relied for a grand leap in the level of knowledge and understanding of the material by application.

The purpose of this work is to look at e-learning in a different light. Do electronic mobile devices and e-resources are used as part of e-learning as unauthorized tools during the exam? To verify the extent of this phenomenon. Whether it is ubiquitous and widespread or it is incidental. Is there any dependence on the average grade, the presence of students at classes?

2 Material and methods

The study was limited within the faculty “Technics and technologies” – Yambol, Trakia University – Stara Zagora, Bulgaria. The students participating in this study were selected randomly without regard to gender, grade point average, etc. Respondents were anonymous 79 students (44 women and 35 men) from all disciplines, courses and groups. All students participated voluntarily in the study. They were informed of the purpose and use of the information gathered from the survey. The survey data were collected in May 2016.

A grading scale of five points was used in percentage 0-20%, 20-40%, 40-60%, 60-80%, 80-100% - interval and the grade of students - range scale, allowing participants to show how a different extent they agree or disagree with a series of statements.

3 Results and discussion

The findings of the survey are presented in summary form in Table 1.

Table 1. Results of the survey

№	A question from the inquiry	Data for the respondents				
Q1	Your gender (M-men, W-women)	M - 35		W - 44		
Q2	Your age	under 25	25-30	30-35	35-40	Above 40
Q3	Your average course grade	Average 6	Good 41	Very good 26		Excellent 6
		Intervals of the answers				
		0-20%	20-40%	40-60%	60-80%	80-100%
Q4	What is the extent of your presence at classes?	3	9	18	24	25
Q5	Do you prefer your books to be in electronic instead of in paper form?	8	10	19	20	22
Q6	Do you feel harmed during the exam?	45	16	8	4	6
Q7	Do you use forbidden means during the exam?	35	20	11	8	5
Q8	Do you use educational tools in e-form through mobile devices that is unauthorized during the exam?	44	17	11	3	4

We will examine the students' answers to two questions, and we will try to look for a connection between qualitative variables on two indications.

№	Question	Intervals
Q1	What is the extent of your presence at classes?	a) 0-20%; b) 20-40%; c) 40-60%; d) 60-80%; e) 80-100%.
Q2	Do you use the educational tools in e-form via mobile devices unauthorized during the exam?	a) 0-20%; b) 20-40%; c) 40-60%; d) 60-80%; e) 80-100%.

We will try to look for a relationship between qualitative variables for both indicators i.e. whether students attended classes often use the educational tools in e-form via mobile devices during the exam or between those indicators has no relation. We'll bet the following hypothesis which will denote by H_0: The indicators are independent. We'll bet alternative hypothesis if it does not fulfill the hypothesis H_0, H_1: The indicators are not independent. This means that there is a relationship between the degree of presence of students in classes, that use the educational tools in e-form via mobile devices during the exam (Krastev at al, 2012; 2013; Stoykova, 2014). For our task, we will use the χ^2 (chi-square) analysis which allows for the testing of statistical hypotheses about the relationship between qualitative variables, which is precisely in our case. To measure the strength of the relationship are used coefficients of contingency, among which the most adapted for each dimension of the table of associated indications is the coefficient of Kramer [1].

$$V = \sqrt{\frac{\chi^2}{n * \min(k-1, r-1)}} \quad [1]$$

Where the relationship is: Weak at V=0-0,29; Average for V=0,30-0,59; Strong at V=0,60-1.
Table 2 shows the empirical frequencies. Vertical inflicted levels first indicator (question Q1) and horizontal levels are mapped on the second indicator (question Q2).
The following table 3 shows the expected frequencies.

Table 2. Empirical frequencies

Intervals	0-20%	20-40%	40-60%	60-80%	80-100%	**Total**
0-20%	1	1	1	0	0	**3**
20-40%	6	1	1	0	1	**9**
40-60%	4	5	6	1	2	**18**
60-80%	15	6	2	0	1	**24**
80-100%	18	4	1	2	0	**25**
Total	**44**	**17**	**11**	**3**	**4**	**79**

Table 3. Expected frequencies

Intervals	0-20%	20-40%	40-60%	60-80%	80-100%	**Total**
0-20%	1,67089	0,64557	0,41772	0,113924	0,151899	**3,00000**
20-40%	5,01266	1,93671	1,25316	0,341772	0,455696	**9,00000**
40-60%	10,02532	3,87342	2,50633	0,683544	0,911392	**18,00000**
60-80%	13,36709	5,16456	3,34177	0,911392	1,215190	**24,00000**
80-100%	13,92405	5,37975	3,48101	0,949367	1,265823	**25,00000**
Total	**44,00000**	**17,00000**	**11,00000**	**3,000000**	**4,000000**	**79,00000**

There are restrictions on the use of chi-square criterion: in the four-cell tables, when one of the expected values is less than 5; in other cases, when more than 20% of the cells have the expected values below 5. Here we have 18 cells, whose values are smaller than 5. This limitation is overcome by merging the adjacent varieties. That will do. We will join the intervals of 0-20% and 20-40% to 40-60% and a 60-80% and 80-100% and of question Q2 – will combine 40-60%, 60-80% and 80 -100% in a 40-100% - Table 4 (Krastev at al, 2012; 2013; Zlatev, 2014).
Table 5 shows the theoretical (expected) frequencies.

Table 4. Merging neighboring varieties

Intervals	0-20%	20-40%	40-100%	**Total**
0-60%	11	7	12	**30**
60-100%	33	10	6	**49**
Total	**44**	**17**	**18**	**79**

Table 5. Estimated frequencies

Intervals	0-20%	20-40%	40-100%	**Total**
0-60%	16,70886	6,45570	6,83544	**30,00000**
60-100%	27,29114	10,54430	11,16456	**49,00000**
Total	**44,00000**	**17,00000**	**18,00000**	**79,00000**

To check the hypothesis of independence of the two indicators will calculate statistics $\chi^2 = 9{,}50$; the number of degrees of freedom f=(2-1).(3-1)=2; the minimum level of significance [2], [3].

$$[2] \qquad P\{\chi^2_{12} \geq 9{,}50\} \leq 0.0086 .$$

This means that independent indications likely to get value the same as trying or more is practically zero, because we reject the null hypothesis H_0 and accept the alternative hypothesis H_1: The indicators are not independent - namely, is there a relationship between the degree of presence of students in classes, that use the educational tools in e-form unauthorized by mobile devices during the exams (Krastev at al, 2012; 2013).

$$V = 0{,}34 \quad [3]$$

We will examine the responses of students at two more questions, and we will try to look again relationship between the qualitative variables on two indicators.

№	Question	Intervals
Q1	Your grade point average?	a) Average-Good; b) Very Good-Excellent;
Q2	Do you use the educational tools in e-form via mobile devices unauthorized during the exam?	a) 0-20%; b) 20-40%; c) 40-60%; d) 60-80%; e) 80-100%.

Then will formulate a null hypothesis that will denote by H_0: The indicators are independent. There is no relationship between the the average grade of the students and whether they use the educational tools in e-form via mobile devices during the exam. We will bet alternative hypothesis if it does not fulfill the hypothesis H_0, H_1: The indicators are not independent. This means that there is a relationship between the above-mentioned indicators. Again we will use the chi-square analysis.

Table 6 shows the empirical frequencies. The vertical inflicted levels of first indicator (question Q1) and along the horizontal are mapped levels of the second indicator (question Q2).

Table 7 shows the theoretical frequencies

Table 6. Empirical frequencies

Intervals	0-20%	20-40%	40-100%	**Total**
Average-Good	23	8	16	**47**
Very Good-Excellent	21	9	2	**32**
Total	**44**	**17**	**18**	**79**

Table 7. Theoretical frequencies

Intervals	0-20%	20-40%	40-100%	**Total**
Average-Good	26,17722	10,11392	10,70886	**47,00000**
Very Good-Excellent	17,82278	6,88608	7,29114	**32,00000**
Total	**44,00000**	**17,00000**	**18,00000**	**79,00000**

To check the hypothesis of independence of the two indicators will calculate statistics $\chi^2 = 8{,}49$; the number of degrees of freedom f=(2-1).(3-1)=2; the minimum level of significance [4], [5].

$$P\{\chi_9^2 \geq 8{,}49\} \leq 0.014 . \quad [4]$$

The latter means that independent indicators likely to get value the same as trying or greater is almost zero because we will reject the null hypothesis H_0 and accept the alternative hypothesis H_1: The indicators are not independent – namely, can we there is a connection between the average grade of the students and whether use training tools in e-form via mobile devices, unauthorized during the exam.

$$[5] \qquad V = 0{,}32$$

We will examine the students' answers with more questions and will try to look again relationship between the qualitative variables on two indicators.

№	**Question**	**Intervals**
Q1	Do you prefer your books to be in e-form rather than in paper form?	a) 0-20%; b) 20-40%; c) 40-60%; d) 60-80%; e) 80-100%.
Q2	Do you use the educational tools in e-form via mobile devices unauthorized during the exam?	a) 0-20%; b) 20-40%; c) 40-60%; d) 60-80%; e) 80-100%.

Then will formulate a null hypothesis that will denote by H_0: The indicators are independent. There is no relationship between that students prefer the educational tools in e-form than in paper form and whether they use learning tools in e-form via mobile devices during the exam. We will bet alternative hypothesis if it does not fulfill the hypothesis H0, H1: The indicators are not independent. This means that there is a relationship between the above-mentioned indications. Again we use the chi-square analysis (Stoykova, 2014)

Table 8 shows the empirical frequencies. The vertical inflicted are levels of the first indicator (question Q1) and along the horizontal are mapped levels on the second indicator (question Q2). Table 9 shows the theoretical frequencies.

Table 8. Empirical frequencies

Intervals	0-20%	20-40%	40-100%	**Total**
0-60%	22	8	7	**37**
60-100%	22	9	11	**42**
Total	**44**	**17**	**18**	**79**

Table 9. Theoretical frequencies

Intervals	0-20%	20-40%	40-100%	**Total**
0-60%	20,60759	7,96203	8,43038	**37,00000**
60-100%	23,39241	9,03797	9,56962	**42,00000**
Total	**44,00000**	**17,00000**	**18,00000**	**79,00000**

To check the hypothesis of independence of the two indicators we will calculate $\chi^2 = 0{,}63$; the number of degrees of freedom f=(2-1).(3-1)=2; the minimum level of significance [6], [7].

$$[6] \qquad P\{\chi_9^2 \geq 0{,}63\} \leq 0{,}728.$$

This means that in independent indicators likely to get the same value as occurred while trying or very large, therefore we will accept the hypothesis H_0: The indicators are independent – namely, we can consider that there is no relationship between whether they prefer learning tools in e-form and whether used the educational tools in e-form unauthorized by mobile devices during the exam.

$$V = 0{,}08 \qquad [7]$$

We will examine the responses of students at two more questions, and we will try to look again relationship between the qualitative variables on two indicators.

№	Question	Intervals
Q1	Do you feel harmed during the exam?	a) 0-20%; b) 20-40%; c) 40-60%; d) 60-80%; e) 80-100%.
Q2	Do you use forbidden means during the exam?	a) 0-20%; b) 20-40%; c) 40-60%; d) 60-80%; e) 80-100%.

Then will formulate a null hypothesis that will denote by H_0: The indicators are independent. There is no relationship between the whether students feel harmed and that they use unauthorized tools during the exams.

We will bet alternative hypothesis if it does not fulfill the hypothesis H_0, H_1: The indicators are not independent. This means that there is a relationship between the above-mentioned indicators. Again we will use the chi-square analysis.

Table 10 shows the empirical frequencies. The vertical inflicted are levels of the first indicator (question Q1) and along the horizontal field are mapped levels of the second indicator (question Q2).

Table 11 shows the theoretical frequencies.

Table 10. Empirical frequencies

Intervals	0-20%	20-40%	40-100%	**Total**
0-60%	31	13	17	**61**
60-100%	4	7	7	**18**
Total	**35**	**20**	**24**	**79**

Table 11. Theoretical frequencies

Intervals	0-20%	20-40%	40-100%	**Total**
0-60%	27,02532	15,44304	18,53165	**61,00000**
60-100%	7,97468	4,55696	5,46835	**18,00000**
Total	**35,00000**	**20,00000**	**24,00000**	**79,00000**

To check the hypothesis of independence of the two indicators will calculate $\chi^2 = 4{,}81$; the number of degrees of freedom f=(2-1).(3-1)=2; the minimum level of significance [8], [9].

$$[8] \qquad P\{\chi_9^2 \geq 4{,}81\} \leq 0{,}08.$$

The latter means that in independent indicators likely to get value the same as occurred while trying or greater: it is small, therefore we will reject the null hypothesis H_0 and accept the alternative hypothesis H_1: The indicators are not independent – namely, we can believe that there is a relationship between whether students feel harmed and that use unauthorized tools during the exams.

$$[9] \qquad V = 0{,}24$$

4 Conclusion

The results of the survey can be summarized as:

- Students who did not attend or were present relatively few in classes are the most likely to resort to unauthorized tools during the exams (Results of the survey).
- Students with the lowest grade are the most likely to resort to unauthorized tools during the exams (Results of the survey).
- We can consider that there is no relationship between whether the students prefer educational materials in e-form and unauthorized use of the educational tools in e-form via mobile devices during the exams.
- The Kramer ratio is virtually zero, which means that this relationship is so weak that it can be ignored.
- Students who feel harmed during the exams, by one reason or another, are exactly those who do not use unauthorized tools during the exams.
- The phenomenon of unauthorized use e-resources and e-services as part of e-learning during the exams does not have mass character and has not acquired alarming proportions.
- Students who have resorted to that unauthorized tools do not keep to receive in-depth knowledge of the course. These are the students with the lowest school attendance and lowest grade point average.

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Study on the Use of the Didactic Methodology in the Training of the Native Digital

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Abstract

Digitalization makes its presence felt in such a way as to be visible in most fields. Teachers must adapt the teaching process to the needs of the new generation of students and to use more and more digital teaching to motivate his students to learn, taking into account that these now have access to information anytime, that is to a single click away. The study proposes to measure the perception of the teachers in relation to the methodological needs and the consequences that implicates the teaching process which is specific to the native digital generation. In this order it has been carrying out a constatative pedagogical research using the method of the investigation on the basis of the questionnaire administered to a nonprobabilistic sample made up of a group of 35 teachers with the different level of expertise and from different institutions of higher education. The questionnaire aims to manage the perception of the teaching staff to the use of teaching digital methods which is their opinion about the change of the curriculum within for the optimization of the training digital competence and also in which way the students are using digital tools for their education. In the last, we will like to find out which are the influences of positive and negative effects of the use of various devices in the formal education.

Keywords: native digitals, teaching process, digital teaching, digital education

1 Foreword

These past years, IT development has decisively influenced the educational process, in the sense that learning is no longer limited to the mere acquisition of knowledge and the trainable pupil no longer is a passive consumer of knowledge. In the new context, knowledge becomes dynamic and transferable, it can be easily shared to others and access to knowledge is not limited. Information is available to the teacher and to the pupil at the same time, which was unimaginable in the past, in the time of the unique handbooks, of additional reading or of the thousand page encyclopaedias and compendia, 'deemed to be reliable only on account of their considerable sizes, for instance, as people could be sure that the items of information that they contained, even though it became obsolete, was carefully checked by experts in the field. All these no longer run today. Each of us may publish on the Internet, which means that we have to turn into critical consumers of knowledge, by taking the task of checking up what we read, as book editors used to do. And this is a skill that needs learning – even by the *digital natives*, who are not very much aware thereof.' (http://www.dadalos.org/ web_20_rom/ educatie_20.html).

To learn today means to get updated information from the Internet, to share knowledge and ideas within the social networks, to discuss and to actively contribute to the contents available therein (Richardson, 2010).

At present and especially in the future, the didactic process will be influenced by the PC and the Internet, so that out of the eight key skills, the digital one, which tackles with the confident and critical utilisation of the technology from the computing society will become the most important one. ‘We have to be aware of the fact that the digitally native pupils and students are surely willing to talk and to share what they know.” (Ceobanu, 2016).

2 Features of the digital natives’ generation

Controversial yet appreciated, the digital natives’ generation constitutes an interesting topic to the theoreticians and the practitioners in various fields of knowledge.

This generation was ‘born’ in the digital environment, as its representatives are surrounded by computers, smart phones and tablets with access to the Internet, being thus used to all the evolutions of technology. The ‘digital native’ term was introduced in the current common language by Marc Prensky and mentioned for the first time in his study, *Digital Natives, Digital Immigrants*, published in 2001. Prensky defined the digital natives as being *young people that grow up surrounded by digital technology*. The term suggests the idea that the young people intuitively know how to use technology, therefore they do not need education or training in this respect. The digital immigrants are the persons born before the appearance and the development of the digital technologies.

In the *Homo Zappiens. Game and Learning in the Digital Era* work (2011), Veen’ and Vrakking’s opinion is that the generation born in the late ’80s has got many acronyms, such as *the Net generation, the digital children, the instant generation* or *the cybernetic generation*.

‘The digital natives are the generation born in the digital space for which the rule is a connected society. It is them who influence the present : informed consumers and active contributors. They live in a culture of the open source, where the constraints linked to time and space have disappeared. They com-municate, socialize, make business in a world full of sensors, they explore the world by such services as *Cloud, Mobile payment* and have a culture of sharing. This generation praises technology in a fairly prag-matic way, which induces their mobility and ways of life. Due to technology, which incessantly adjusts itself to their skills, life means gamification and ubiquitous learning to them. They make sure that the companies’ values are in line with theirs and search for transparency and integrity. They demand freedom in everything they do – from the freedom of choosing to the freedom of expression – and they want that as quickly and convenient as possible. They are the new scrutinisers’ (Dumitrescu, 2013, p. 59-60).

The digital natives are also referred to as *The Z Generation*, *The Eyes Down Generation* (looking downwards, to the device that they are using) and *Homo zappiens* in the literature. We use the ‘native’ term for underlining the fact that the members of this group were born in a world where technology and digitalisation are so ubiquitous that are considered to be something ordained. These digital natives are children born with mobile technologies and the Internet. ‘Technology has shaped not only how they navigate the world, but also how they see themselves. Each generation imagines itself as rebellious and iconoclastic. But none before has felt as free to call bullshit on conventional wisdom, backed up by a trillion pages of information on the web and with the power of the Internet to broadcast their opinions.’ Jerry Adler asserts in his article *Meet the First Digital Generation. Now Get Ready to Play by Their Rules* in the Wired magazine (Catalano, Persecă, 2016).

Tapscott (2011) lists eight norms of the Net generation, which, once decrypted, are able to change the sometimes conservative attitude of the *digital immigrants* towards them. Thus, ‘they value *freedom* – the freedom of being as they are, the freedom of choosing. They want *to customise* everything. They have learnt to be *skeptical*, to check what they see and read. They appreciate *honesty* – to be honest, polite and to keep your word. They are excellent *collaborators*. They like *speed*. They like to *innovate* and want *to have fun*.’

3 Trial goal, methodology and results

An important and maybe highly relevant feature of the digital natives is that they are less aware of their interaction with technology.

Digital natives have got a great force of informing, of collaborating, of getting involved and of getting mobilised at the global level, they care about the global social problems and they grow up handling the very powerful tool that is the Internet. This differentiates them from the previous generations.

This generation has not appeared everywhere at the same time, but the number of its representatives is growing and in the future they tend to become a global supreme generation. Which is why faculties have to resort to didactic methods suitable to the interests and the skills that they possess, by even using *digital methods.* These ones are seen as alternatives to the traditional ones, thought to be superior in training this generation, but of course, being only used in combination with a series of digital resources. If combined in this way, they can have the form of digital games – mathematical, linguistic, geographical etc., of interactive presentations with gap texts in PPT, study platforms, specific methods of accessing data libraries, on-line magazines, books from the digitalised mandatory bibliographical references, the resorting to on-line dictionaries and so forth (Catalano, Persecă, 2016).

The trial that we initiated aims at measuring the faculties' perception about the methodological needs and the didactic consequences inferred by the training process specific to the digital natives generation. We therefore carried out an ascertaining statistical research by using the method of inquiry based on a questionnaire applied to a non probabilistic sample composed of 35 faculties with a different level of expertise, belonging to different classes and educational facilities.

The questionnaire is based on items targeting:

- the extent to which the faculties use didactic methods that exploit and call for digital skills in the instructive-educational process and what kind of methods they resort to in this case;
- the pupils' perception towards digital teaching-learning-assessment;
- the specific way in which the pupils use the digital tools in the formal education ;
- the possible hindering factors caused by the IT utilisation;
- the identification of potential curriculum or legal modifications likely to uphold the digital approaches specific to the new generation of digital natives.

The result of each question was analysed from the statistical-mathematical viewpoint and was put down in percentages. Need is to say that the sample included persons aged between 40 and 50 ; they were the most respondents, namely 57.14 %, followed by those aged between 30 and 40 (28.57 %) and by the faculties aged between 20 and 30 : 14.29 %.

After processing the data obtained we have noticed that 80 % of the respondents use the digital methods to a little extent, 17.14 % every day and that 2.86 % do not resort to such modern approaches. In contrast, the respondents' answers about the relationship between motivation in learning and the use of the methods that require digital skills show the fact that the pupils are very motivated to learn by means of the digital methods, seen as alternatives to the already known ones (97.14 %), whereas only 2.86 % think that the pupils have not adjusted themselves to the digital teaching approaches.

The most frequently used digital teaching methods, procedures, techniques and tools used by the questioned persons are 20 % represented by PowerPoint presentations, Word and Excel documents, Paint and interactive lessons, 11.43 % by movies, documentaries and cartoons, 8.57 % by interactive games. 45.71 % answered that all the variants listed above were used and 14.29 % said *I don't know.* or *I choose not to answer.*

The item that was aiming to find out the respondents' opinion about the possible hindering factors triggered by the utilisation of the didactic methodology that facilitates the digital skills indicates us that 25.71 % of the questioned faculties think that methodological digitalisation has got negative effects amongst children, 2.86 % think that it does not have negative effects, whereas 71.43 % of the respondents claim that the utilisation of the digital didactic approaches will gradually replace the traditional methodo-logy and in the future only the pupils who do not possess digital skills will be influenced negatively.

The majority of the questioned teachers think that they need a more explicit legislative support likely to uphold the gradual implementation of the logistic, methodological and curriculum-related digital approaches, because the digital natives' generation calls for new adaptations and rearrangements of the information contents and of the way in which these contents are taught.

The answers offered also show a series of threats and limitations of the full implementation of the digital approaches in schools:

- Even though most pupils have got digital devices and access to the Internet, there are certain areas where pupils do not enjoy them, hence digital inequality.
- All the schools cannot foster the digital methods and resources, either because they lack the necessary endowments or because the faculties do not use them appropriately.
- There is still resilience to change, all the faculties are not flexible, so that the passage to digital teaching and assessment and, implicitly, to the utilisation of the digital resources, seems to be impossible in such instances.

Conclusions

Paradoxically, even though the digital native grows up surrounded by the new technologies, the digital skills are not assimilated very successfully by all the pupils and the absence of guided learning can lead to situations in which the digital natives never succeed in reaching their potential, just like in any other field, so that we face a high inequality to access to the resources ; we think that it is school that is able to balance this discrepancy, by its human and material resources.

Need is to specify the fact that despite the increasingly high interest in investigating the Net generation's behaviour, this is not yet a global generation and in certain countries it is not even born yet. Given that approximately two thirds of the world's population does not have connection to the Internet or that there are obvious disparities between the rural environment and the urban one from the point of view of connectivity and of the families' economical potential, this aspect remains debatable.

On reflecting upon the theoretical considerations and on comparing the results obtained, one may say that the new generations of trainable pupils require a reorganisation of the didactic attitude and of the entire training design, seeing that traditional pedagogy is able to provide relevant theoretical and practical supports as the foundation of a new educational architecture consistent with the needs of *Generation Z* and furthering a new form of education – *interactive education*, seen as an approach that enables the trainable pupils to cover contents, to shape habits and skills in the rhythm of their own development.

Interactive education facilitates a participative-type virtual relational habitat, which enables a quick change of information in a dynamic, extended and collaborative learning community. This new form of education goes beyond both formal, non-formal and informal, so that family, school and the community witness their securing from the social, emotional-motivational and cognitive point of view.

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Questioning the power of higher education. Taking the long way from in taking knowledge to building enjoyable learning experiences

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Abstract

There is a growing scientific interest in researching academic learning contexts and processes in order to assess the capacity of higher education to provide students with authentic learning experiences. This paper aims to present a research study conducted to answer the following question: to what extend academic learning experiences can increase the enjoyment of learning in students by creating contexts to promote deep, self-motivated, and self-regulated learning. In order to answer the question, an empiric study was conducted on students in Romanian regular universities. The research followed an intensive longitudinal design. The selection of subjects was based on a purposive sampling approach. The final sample covered a number of 32 subjects. At random times, the subjects completed brief surveys about their behaviors, feelings, and thoughts during ten weeks. The selection of learning experiences was based on random. By doing so, both the researcher and the subjects were actively involved in data collection. All data were analyzed. The research reveals that enjoyment of learning is a state emotion, varying between- and within-subjects. A mixed model analysis was conducted to investigate whether an association between processing strategies exists and what is their nature. In addition, the role of learning context and time in the development of enjoyment and processing strategies was tested. The article concludes by presenting implications for teaching. Further research directions are presented.

Keywords: enjoyment of learning, processing strategies, experience sampling methods, mixed models, learning patterns

1 Introduction

Do emotions shape the world? The answer remains open-ended. Meanwhile, a corpus of scholarly opinions emphasize that academic communities are affective communities (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). The last two decades marked a proliferation of studies regarding achievement emotions (AE)(Goetz, Sticca, Pekrun, Murayama, & Elliot, 2016). Achievement emotions are usually related to achievement activities or achievement outcomes (Pekrun et al, 2011, p. 37). As the cited authors argue, this increasing interest in researching emotions in academic contexts is based on empirical evidence showing the effect of AE on learning behavior, university attainment, and outcomes. In the same line of thoughts, there are voices warning that researchers have insufficiently considered the role of negative and positive emotions in achievement (Valiente, Swanson, & Eisenberg, 2012). The emotional diversity (Peixoto, Mata, Monteiro, Sanches, & Pekrun, 2015) of the academic world has been proved and researched (see the work of Goetzet al, 2016; Hagenauer & Hascher, 2014; Pekrun, Goetz, Titz, and Perry, 2002;). However, further work is needed. Raver (2002) states that emotions matter and the association of cognition and emotions may result in consistent understanding of academic achievement. Liew (2012) cite scholarly articles to emphasize the positive relation between dispositional regulation and achievement. Most frequent investigated emotion appears to be anxiety (Valiente et al., 2012). Duchesne, Vitaro, Larose, and Tremblay (2008) found a negative association between anxiety and learning outcomes, respectively school atteinment. In contrast, Pekrun, Elliot and Maier (2009) found no relation between achievement-related anger and grades. Meanwhile it is a clear interest in investigating negative emotions, a hypothesis of a possible difficulty in researching positive emotions has been launched (Valiente et al., 2012). As a framework for defining emotions, the control value theory was used (Pekrun, Elliot, and Maier, 2009). The control value theory supports the analysis of various emotions in different achievement contexts (Pekrun et al., 2011, p. 36). In this acception, emotions are viewed as 'sets of interrelated psychological processes, whereby affective, cognitive, motivational, and physiological components are of primary importance'(Pekrun et al., 2011, p. 36).To measure achievement emotions in academic contexts, Pekrun et al. (2011) developed the Achievement Emotions Questionnaire (AEQ), entailing scales for nine emotions (enjoyment, hope, pride, relief, anger, anxiety, hopelessness, shame, and boredom). The present research was interested in enjoyment of learning as a positive and activating achievement emotion.

1.1 The current study

The current study uses the three types of processing strategies theorized by Vermunt (1994; Gibels, Richardson, Donche, & Vermunt, 2014) to research their relation with achievement emotions Goetz et al., 2016; Pekrun et al., 2011). When discussing the theory of learning patterns, Vermunt (2004) suggest that three types of processing strategies are possible, respectively stepwise processing, deep processing and concrete processing. In addition, in undirected learning patterns, any processing of information becomes difficult.Deep processing is characterized by relating and structuring and critical processing of information. Stepwise processing refers to memorizing, rehearsing, and analysis of information, while concrete processing is focused on applying the information in various contexts. Generally, stepwise processing is related to reproduction-oriented pattern; deep processing is associated with the meaning-oriented pattern, and concrete processing is a component of apllication-oriented pattern (Gibels et al., 2014, p. 6). Therefore, the present study was designed to shed light on the relation between the enjoyment of learning and processing strategies in the context of higher education. It investigates whether this associations exists and what is their nature. In addition, the role of learning context and time in the development of enjoyment and processing strategies was tested. Based on this purpose, the paper unfolds the method used to collect and analyze data, presents the results and proposes a discussion of them.

2 Method

2.1 Participants

A number of 32 under graduate students were selected following a purposive sampling strategy. The subjects were enrolled in bachelor programs in two Romanian universities. A larger number of students applied for the research project but only 32 of them were selected based on preliminary interviews. From that, fourteen were female and eighteen were male. The age of the subjects in the sample ranged from nineteen to twenty-three years. The participation in the study was volunteer. At the end of the study, all the participants received financial incentives.

2.2 Study design

Action research was preferred to conduct the study. A ten-week research framework was designed to entail all type of academic activities (courses, seminars, individual study, mid-term and final exams). To support the research framework, the author preferred an intensive longitudinal approach.

As Zirkel, Garcia, and Murphy (2015, p. 1) argue, ESM 'examine individuals' experiences in the context'. Larson and Csikszentmihalyi (1983 as cited by Zirkel et al., 2015) are responsible for the inception of ESM concept in the field of flow research. The particular feature of ESM is the 'ecological' assessment of experiences, behaviors, thoughts, and feelings at the moment they happen on repeated time occasions (days or weeks). A number of advantages have supported the increasing use of ESM in health, clinical, social psychology and educational research (Fisher and To, 2012, p. 865). Zirkel and her collaborators (2015, pp. 8-9)identify several key methodological aspects as follows. First, ESM gives access to subjective experiences lived in settings sometimes hardly accessible to the researcher. Moreover, ESM provides point-in-time access or proximity to real life experiences. By applying ESM, the researchers acquire a large number of assessments of individuals' experiences and become able to observe within-persons variations of a certain number of variables. By doing so, ESM affords a level of statistical power. When discussing the reasons for using ESM, Fisher and To (2012, p. 866) emphasize that ESM reduces the bias that may appear in retrospective studies and unfolds within-person changes ever a period of days or weeks.

A key decision in ESM research involves the plan for sampling moments of experience, including how, how often, and for how long to ask for reports, declare Fisher and To (2012, p. 869). Zirkel, Garcia, and Murphy (2015) identify three primary means to sample experience in ESM studies namely: (i) random sampling; (ii) fixed sampling; and (iii) event-based sampling. In random sampling, the participants assess their experiences at random times. The researchers can send prompts or alerts via text messages or e-mails. Random and event-based sampling were applied in the context of this research. Researchers to conduct ESM studies can use to various technologies: ESP and iESP, CAES, MyExperience (see Fischer (2009) for a critical review of these technologies). In this study, P.I.E.L. Survey was used to collect data.

2.3 Measures

To assess students' enjoyment of learning, the scale enjoymentof the Achievement Emotions Questionnaire (AEQ) was applied (see Pekrun, Goetz, Frenzel, Barchfeld, and Perry, 2011 for a detailed discussion on the construction, reliability, internal validity, and external validity of the AEQ). Subjects in the study were asked to report repeatedly how they felt during classes, individual study, tests or exams. The initial version of AEQ has good to excellent reliabilities for all the scales $\alpha = .75$. with positive interitem correlations above $.30$threshold(Pekrun et al., 2011, p. 42). Similar coefficients were computed for the version that was applied in the current study $\alpha = .73$.

As AEQ is a self-report questionnaire, the items were rated on 5-point Likert scale ranging from *Totally agree* to *Totally disagree.*

As structural components of learning patterns, processing strategies were assessed. Three types of processing strategies (deep processing, stepwise processing, and concrete processing) were measured with the respective scales of the Inventory of Learning Styles (ILS) questionnaire (Vermunt, 1994). The reliabilities of all the scales are good to excellent $\alpha > .75$.

2.4 Procedure

As stated in the above section, a ten-week research framework was designed. In the first two weeks preliminary meetings were scheduled. A primary role of these meetings was to learn more about ESM.In the third week, the participants started to answer the AEQ questionnaire. As the random sampling was chosen for this study, the participants received one to three weekly alerts on their mobile phones to complete the survey in different contexts. All the collected data were analyzed as described in the subsequent section.

2.4 Data analysis

Data collected through repeated measures was prepared for mixed-model analysis by using the Statistical Package for Social Sciences (SPSS, IBM®). The database was designed in long format. Thus,the subjects self-reported the enjoyment of learning in three contexts (classes, individual study, and evaluation). A number of 1138 observations was computed. From that, 37.5% referred to classes, 32.1% assessed in individual study contexts, and 30.4% focused on evaluation situations.Pearson bi-variate correlations (two-tailed) were carried out, as well as univariate analyses (ANOVA). To investigate the effect of enjoyment of learning on processing strategies mixed models analysis was preferred. Two levels of analysis were used. As ESM suppose repeated measures for each subject, the series of repeated measures for each individual represented the first level of analysis and the individual level becomes the second one(Fullagar & Kelloway, 2009). To analyze the effects of enjoyment on processing strategies at the intra-individual level, the enjoyment was regressed to processing for all the subjects in the sample. The parameters of the first level model were regressed on the second level variable. The current study assumes that H1: processing strategies are associated with the enjoyment of learning and H2: enjoyment of learning is related to deep and concrete processing strategies.

3 Results

In this study, the author was interested to assess the enjoyment of learning in various academic contexts and the influence of enjoyment on processing strategies.Table 2depicts descriptive statistics for all the variables in the study.

Table 1. Descriptive statistics for the investigated variables

Model	Mean	Standard deviation	Minimum value	Maximum value
Enjoyment	7.79	1.29	3	15
Deep processing	27.09	.89	11	55
Concrete processing	17.23	.97	3	25
Stepwise processing	37,46	1,23	11	55

In the beginning, the author searched for the within and between subjects variations in enjoyment and processing strategies. Four false models were designed to assess the variations in enjoyment and processing strategies. In all models, maximum likelihood (ML) estimation was used. In Table 2, the parameters of the model indicate that there is within and between variance in enjoyment of learning: $\gamma_{00} = 7.762500, \tau_{00} = 1.997784, \sigma^2 = 9.901786.$ The estimated variance of the random components is $\tau_{00} = 1.997784$, and different from 0: $z = 2.357, p = .018.$ The interclass correlation is $ICC = 0.16$. Based on that, it can be said that 16% of the variance of enjoyment of learning in students can be accounted for by between-students differences and their involvement in academic activities. Following this line, 84% of the variance of enjoyment is explained by individual differences.

Table 2. Parameter estimates and variance components of the null models (N = 480)

Model	γ_{00}	σ^2	τ_{00}
Enjoyment	7.762**	3.901**	1.997*

Deep processing	5.734**	8.720*	2.460**
Concrete processing	1.630*	8.522**	2.020*
Stepwise processing	3.433**	8.734*	2.101**

Note: *$p < .05$; **$p < .01$

In case of deep processing measure, $\tau = 2.460, ICC = 0.22$. Therefore, we can say 22% of the variance of deep processing strategies is accounted for by the between individual differences. As for the concrete and stepwise processing, 19% of variance is explained by between-subjects differences.Based on this, the null hypothesis can be rejected and H1 can be accepted: there is between- and within- individual variation in enjoyment of learning and processing strategies in the investigated sample.

By analyzing within-subjects effects, the ANCOVA analysis suggests that the time variable does not influence the level of enjoyment $F(14, 465) = .082, p = .471$. Meanwhile, the context affects the development of enjoyment $F(2, 477) = 10.389, p = .0003$. Mean differences are significant at .05 level for the pairs classes and evaluation ($M = 1{,}598, p = .000$), respectively for individual study and evaluation ($M = 1{,}213, p = .004$. Thus, the students would prefer to be in classes or in self-paced learning situations rather than in evaluation contexts. There are no significant differences for classes and individual study contexts.

As for the second hypothesis, this suggests there would be an association between enjoyment of learning and processing strategies. Three models were designed with each of the three processing strategies as dependent variable. The t tests for fixed effects are statistically significant for all the three models ($p < .05$). For the model enjoyment – deep processing strategies, $\gamma_{11} = .20, p < .05$. In the case of where the enjoyment was regressed to concrete processing, $\gamma_{12} = .19, p < .05$. Finally, for the model where enjoyment was regressed to stepwise strategies, $\gamma_{13} = -.23, p < .05$.For the first two models, the direction of the slope indicated that positive levels of enjoyment are associated with high use of deep and concrete processing strategies. With respect to the third model, the results indicate that low levels of enjoyment can conduct to stepwise processing.

4 Discussions

The current researched focused on understanding the relation between enjoyment of learning and processing strategies by applying experience sampling methodologies. Research findings in the field of positive emotions revealed a positive association between positive activating achievement emotions and attention parameters, the nature of motivation to learn, use of learning strategies and use of self-regulatory strategies Fredrickson 2001; Goetz et al., 2016; Pekrun, Goetz, Titz, & Perry, 2002). There are authors warning that positive emotions decrease by the years of schooling (Hagenauer & Hascher, 2014).Hagenauer and Hascher (2014), discussing other scholars opinions, argue that enjoyment is accompanied by desirable learning behaviors (p. 21). These effects refer to deep processing, mental flow, and metacognitive strategies. The study in this paper supports this opinion. As the variance coefficients indicated, there is between- and within-subjects variance in enjoyment of learning and in processing strategies. Moreover, there is a statisctically significant association between enjoyment and deep, respectively concrete learning strategies. Deep processing strategies are associated with meaning-directed learning pattern, while concrete processing is related to application oriented-pattern (Gibels et al., 2014; Vermunt & Vermetten, 2004). According to Martínez-Fernández and Vermunt (2015), the two cited learning patterns are frequently associated with academic succes. In opposition, stepwise processing is a component of the reproduction-oriented pattern, a predictor of academic failure. Thus, by creating highly enjoyable learning experiences, the teachers can influence the variance of learning patterns accross time and contexts, as Gibels et al. (2014) suggest. In the present study, the enjoyment was a function of learning context, but not one of time $F(14,\ 465) = .082, p = \ .471$. Furthemore, more than half of the subjects reported low levels of enjoyment (in 55% of the observations, the scores of enjoyment were lower than 7; the maximum value is 15). Individual study is associated with higher scores in enjoyment in this particular study.

The current study unfolds two main findings. First, enjoyment of learning is predominantly a state emotion. This is a valuable information for teachers. If the enjoyment of learning is context sensitive, thus it can be changed by appropriate instructional design. Further research can be conducted to assess weather the variations in enjoyment depend on the opportunity to learn or on the focus on students of teacher.

The second finding is related to the positive association between enjoyment and deep and concrete processing strategies. Stepwise processing is usually based on underlining, reading and re-reading strategies. As Vermunt (1996) says, in this case, the main conception of learning in students is that of intaking knowledge. It is to be mentioned that for stepwise processing strategies the highest mean score was computed (see Table 1). As expected, being in contexts that stimulate the intaking of knowledge is not an enjoyable activity. Moreover, individual study is frequently related with this type of processing strategy. This finding is also relevant for teachers because negative learning patterns (such as undirected and reproduction-oriented learning patterns) usually integrate stepwise processing (Gibels et al., 2014; Vermunt & Vermetten, 2004) and the conception that learning mens intaking knowledge. In this case, the teachers can vary in the nature of learning tasks and become active external regulators. Students in this cluster does not apply a variety of learning strategies and tend to minimize the role of internal regulation. They usually prefer external regulation based on teachers and fellows' actions. Negative consequences of this learning behavior can be envisaged.

5 Conclusions

In this article, the author aimed to investigate the relation between enjoyment of learning and processing strategies. In *Introduction,* the paper argued that researching emotions and learning is a key trend in educational research. To conduct the study, ESM was preferred whereas this methodology gives access to momentary life experiences and offers statistical power through repeated mesures. The research concluded there is between- and within- subjects variance in enjoyment of learning and processing strategies. The mixed models analysis revealed a positive association between enjoyment and deep and concrete processing strategies. Furthermore, high levels of enjoyment predict the use of deep learning approaches.

In sum, the paper has a methodological contribution to the use of ESM in education research. In addition, it promotes achievement emotions research in relation to learning patterns in order to raise awareness of the importance of emotions in promoting authentic learning in academic environments.

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Online Resources for Teaching Programming to First Year Students

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Abstract

The scope of this paper is to present online resources for teaching the C programming language to first year students, as used by the authors. The resources can be categorized as administrative, helping teachers to manage issues like attendance and handouts and learning resources, used as mandatory or complementary teaching resources. The learning resources are classified according to their level of difficulty: novice, intermediate and advanced. With the use of this learning resources we aim at keeping students in the learning loop and reducing learning frustration, by suggesting the resources with the appropriate level of difficulty. Also, some of the resources present visual and interactive features, as an alternative to classic analytical learning methods. Further plans to implement a tracking solution for the code written by the students shall be introduced, with the aim of getting better insights on the students' learning evolution.

Keywords: Online resources, Teaching resources, C programming language

1 Introduction

The purpose of this paper is to present online teaching resources used by the authors to teach first year students programming techniques. Other teachers and/or students can use these resources to compile a programming course or access them for a better understanding of programming topics.

The resources mentioned in this work were selected to match programming topics taught during a mandatory 2nd semester programming course called *Computer Programming – Programming Techniques (PT), visit http://pt.becheru.net/,* held during a 4-year engineering speciality on *Computers* at the *University of Craiova.* The programming language chosen is *ANSI C, C99 standard,* motivated by its industry wide use, cross version compatibility and time survival. The focus of this course is on elementary *Computer Science* algorithms, e.g. sorting algorithms, the programming language is only considered as a tool of practice. This is also motivated by the fact that students study the *ANSI C* programming language in the 1st semester. Nevertheless, some of the resources presented here are specific for the *ANSI C* programming. Five hours are allocated per week for this course, 2 for the lecture, 2 for the laboratory works and 1 for project development/coaching. The teaching period stretches for a period of 14 weeks, totalling 70 hours of teaching. The students need to pass a 3-fold evaluation process: written exam, laboratory test and project development plus some mandatory homework. The written exam focuses on the understanding of algorithms and logic. The laboratory test establishes their ability to implement elementary algorithms in *ANSI C.* The project development looks at the students' ability to use topics taught to develop solutions for real life problems, e.g. finding shortest routes according to some train time tables. Also, students have to write a technical report for their project, using *LaTeX (Latex project),* explaining and detailing the methods used.

For a better overview of the PT course we shall further mention some of the topics taught: algorithm design and analysis, sorting algorithms, abstract Data types, Graphs representations and traversal, dynamic programming, NP-completeness.

For the above mentioned course, roughly 120 students are registered each year. Thus, a content management system (CMS) is needed for course/laboratory/project materials. The university or faculty does not offer or enforce any educational CMS (e-CMS). Implementing and managing such a material management system is in the attributions of the teacher and teaching assistant. Due to time and financing restrictions, the e-CMS should be open source, easy to install and easy to manage. Another feature that is a must, in the case of this course, is a homework/project submission system.

The introduction of additional online learning resources is motivated by the following issues. There is a limited amount of time for the teacher to discuss with each student, thus teachers can redirect students to online resources. Online learning resources are easily reachable and in some cases they are kept up to the. From our experience, we observed that the amount of prior computer science (CS) knowledge possessed by 1st year students varies. Therefor, the resources offered to each of them should be adapted to their level of knowledge. Students have various methods of learning which are influenced by their personality and background. Thus, students can choose from a variety of learning materials the ones that suite their learning style.

Keep in mind that we do not imply that the online resources presented are the best. Also, we do not imply that they are sole unique solution to our types of problems. The reader should view the resources mentioned below as possible solutions.

The paper is structured as following. The next section focus on administrative teaching tools. In the third section we enumerate and motivate learning resources for beginner, intermediate and advanced students. The forth section concludes our paper with a discussion on the possible benefits of a code tracking solution for students.

2 Administrative Learning Resources

Our discussion on administrative learning resources starts by identifying the most basic features that teachers and students need during the PT course. We need to keep in mind that the use of this features and installation should be as straight forward as possible, due to time restrictions. Thus, any solutions e-CMS solution considered should be intuitive and if possible familiar. Also the solution used should have a common entry point for all features, e.g. an internet site with a page for every feature.

We identified the following features as being a necessity for the PT course, from the teachers' perspective:

- Publish/give access to teaching materials (electronic versions).
- Keep track of marks and laboratory attendances. A student must have an attendance of at least 75% of the classes in order to have the right to sustain the final written exam.
- We consider transparency as a must, thus any course material, mark, attendance situation should be available for anyone to consult.
- Receive homework/projects via electronic manner. This is the case as students usually need to write C language code or a technical report.

Among the basic needs of the students we identified the following features:

- Have access to teaching materials.
- Consult their current status for the course: marks, attendances.
- Communication manner with the teacher.

We discovered that students are already overwhelmed by the number of various e-CMS solutions they have to manage for other courses. Thus, the chosen e-CMS should be straight foreword to use, as we do not want to add to the current level of students' frustration.

Probably the most known and used e-CMS solution in universities is *Moodle* (Dougiamas and Taylor, 2003), or Moodle-based solutions like *Mudri* (Nebić and Nemčanin) from university of Rijeka, Croatia. *Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalised learning environments* (Moodle website). Although we adhere to the idea of using *Moodle*, time, personnel and monetary restrictions make it very hard to implement such a system.

The first decision taken was that the common entry point for the features our e-CMS will have must be an internet website, see *http://pt.becheru.net/*. Therefor, all the features would be easily accessible and the transparency requirements would be partially met. However, building and maintaining an website reduces teaching time, thus we needed a solution that will imply minimum administration and if possible no installation requirements. Such a solution is offered through *Google Sites* (Google Sites), a free cloud based solution for building and easy administration of web-sites.

Having established with a free *Google* product, we looked to other tools offered by the internet leader that would satisfy the mentioned *must have* features. We found that for attendance and marks tracking *Google Sheets* (Google Sheets) is a suitable solution. It offers *Microsoft Excel* like features with internet sharing capabilities. Thus, a calculus sheet can be maintained and updated by the teachers for attendance/marks. The sheet/sheets can be viewed by students through the means of a *read-only link*. Transparency requirements are fulfilled, as anyone has access to the course status and materials. Yet more solutions to teachers'/students' basic needs can be addressed by using *Google Docs* (Google Docs) and *Google Slides* (Google Slides), which are both web-based word processor respectively slide presentation tool. These tools can be used for preparing teaching materials and/or homework. Querying students on various matters could also be done through *Google Forms* (Google Forms). All the materials and homework can be managed and stored with Google's cloud storage solution *Google Drive* (Google Drive). Teacher-student communication can be facilitated through the use of *Gmail* (Google Mail). A bonus factor in using Google's solutions is that the majority of students are familiar with these solutions.

With the above mentioned solutions all the basic needs were fulfilled except one, receive homework/project via an electronic method. Initially we resolved this problem by asking students to send an email to a specific *Gmail* address. However, as we will further prove this resulted on frustration rising on both sides. First of all, email providers have a problem with code sent as attachment due to security issues. Second, some email providers have very limited attachment size. Students also forget to mention their name, and often their email address can not be used for identification.

Google also offers a suite of applications for education purposes called *Google Apps for Education* (Google education suite). The tools offered by Google and mentioned above are also present in this suite. Yet, another tool is accessible through this suite, *Google Classroom* (Google Classroom), offering a *Facebook* like *wall post interactions.* Thus, teachers and students can easily share materials and post opinions. Also, teachers have the possibility to create assignments which are easier to manage due to the integration with *Google Drive.* A folder for each assignment will be automatically created in the teacher's *Google Drive* where each enrolled student will have a folder with the submitted assignment. *Google Classroom* also offers mobile apps for the major platforms *IOS* and *Android*, therefor it is easier for students and teachers communicate and stay up to date.

Although *Google Apps for Education* is a valuable suite for teachers and students that is easy to install and maintain, there was a loss of transparency as only the students could reach the posted materials. Also, our purpose was to reduce student's frustration and not to increase it with another e-CMS. Further more, functionalitie*s similar to Google Classroom* can be reached by using together *Google Sites for material sharing, Gmail for communication and Google Drive for assignments management.* Thus, we decided not to use *Google Apps for Education.*

We are currently using *Google Drive and Google Sites* together with an open source script (Google Drive upload) as a solution for assignment management, e.g. visit *http://send.becheru.net/.* With minor modifications to the script students are able to upload files to teacher created *Google Drive folder*. Further more, the uploader has confirmation of the upload as he can download the just uploaded file.

3 Learning Resources

The learning resources introduced here have the main role of offering complementary information for students, either offering various perspectives on the same concept or totally new information. Some of the resources are indeed mandatory, which we will mention, but the majority are optional. Further more we do not expect students to study all the resources, as the workload is significant. We use these resources to redirect to meaningful materials for better understanding or further reading in case they would like to learn more that we are able to teach them.

We separated the resources into 3 categories for: novice, intermediate and advanced students. In order to understand this categorisation, we have to mention that high schools in Romania have many specialities, and these specialities do not represent a restriction for admission at the university. Thus, some students have serious computer science background while other have no background at all. Unfortunately, the time frame of one semester prior to this course is not sufficient for those with no previous CS background to make up the knowledge difference with those that had a CS high school specialisation. We identified two very dangerous phenomena that arise if teachers ignore the knowledge difference: learning frustration due to the vast amount of information needed to absorb in a short period of time for novices and loss of interest due to no new information/challenges for students with CS background. Thus, we try to avoid the two just mentioned phenomena by offering learning resource according with their level of CS knowledge.

You will find that some of the resources have visual representation or even offer the possibility of interaction. These are offered as an alternative way of understanding CS concepts, which appeal very much to students that have good visual learning skills. Through these tools we try to reduce the learning frustration for those that have not yet developed good analytical thinking. Some of the resource are not even made by academic personnel, nevertheless they are valuable as CS concepts are presented from different perspectives.

3.1 Resources for Novice Students

We define a student as being a novice if she/he has no prior CS knowledge. Otherwise, said she/he had never written more than 1000 lines of code and has major difficulties in developing an algorithm according to CS requirements.

Bits and Bytes (YouTube Bits and Bytes) was a television educational series that had the purpose of teaching the use of computers while explaining basic concepts like: file and data management, computer languages, simulations and games, computer music, etc. Although the series was made in the 1980's the basic concepts of CS still remain the same. The concepts presented here are a must for every computer scientist thus this resource is mandatory for every novice student.

Folk Dance Algorithms (AlgoRythmics) is a series of YouTube videos presenting CS algorithms with the aid of traditional European folk dances. The videos were initiated at the Sapientia University in Tîrgu Mureș and directed by Kátai Zoltán and Tóth László. Among the algorithms presented through this innovative way we mention: bublle sort, quick-sort, merge sort, etc. Based on our experience with first year CS students these videos are highly praised by them.

Yet another YouTube (Carol Herold) video series by a self-taught programmer *Carol Herold* is in our list of resources for novice students. It is a beginner programming course that uses the C language as learning tool. There are 66 videos, lasting from 5 to 30 minutes, that treat various CS concepts like: binary and hexadecimal numbers, pointers and changing data using bitmasks, etc. This tutorial is very useful for novices as it does not assume no prior CS knowledge.

88 C Programs is a book written by *J.T. Kalnay* that includes 88 problems that *exhaustively demonstrates important points of the C language* (Carol Herold). Each problem is stated, explained and resolved in C language. The focus here is on the programming language; thus problems are tailored to meet C language challenges. Here are some of the topics: printf, modulus, while loop, math.h, stack, argc/argv.

3.2 Resources for Intermediate Students

We consider an intermediate student to be one that had written between 1000 and 10000 lines of code and has some prior knowledge in CS. These students usually know how to use basic programming concepts like: while loops, if statements. Also, they have knowledge on very basic algorithms like *bubble-sort.* However, these students lack knowledge on complex algorithms, e.g. *merge-sort,* or on the use of abstract data types, e.g. *stacks.*

Being able to visualise algorithms at work has proven a useful teaching tool. Therefore, we recommend to our students to study algorithm visualisations from the *Department of Computer Science* at the *University of San Francisco* (USFCS). A vast amount of algorithms were visually represented, e.g. red-black trees, Huffman coding.

ADUni.org is the website for the alumni of ArsDigita University, which was a one-year post-baccalaureate program of study at the Massachusetts Institute of Technology (MIT). This program contains an algorithm course (ADUni algorithms) taught by professor *Mark Dettinger* that offers course slides, problem sets, handouts and lecture videos. The course as the entire program starts with very basic concepts, however the difficulty of the topics increases rapidly. Thus we recommend this course to those that have some CS background, such that they are able to keep the learning pace.

By the end of the course we expect our students to be able to determine the complexity of an algorithm, Big Oh complexity. Upon solving problems, we encourage them to look at different algorithms and choose the most efficient algorithm. In order to quickly compare various algorithms, we redirect them to a complexity table (Bigocheatsheet).

Another resource that we recommend to students is a a *Udacity* (Github course) course on *Git and Github* technologies (Github). Thus, students should be able to track multiple versions of a file, track bugs by reverting to previous working versions of a file and seamlessly collaborate. We encourage them to use *Github* as a portfolio of projects developed during the faculty and further.

We consider programming as being an art, thus besides technical knowledge students need to know coding styles, e.g. *K&R* indentation style. One coding style resource that is highly praised is *Linus Torvalds's Linux kernel coding style* (Linux style).

3.3 Resources for Advanced Students

We consider advanced students those that have written more than 10000 lines of code and have an impressive baggage of knowledge when considering algorithms. They are able to solve a problem using the most efficient method either with the least memory or close to optimal computation time. Usually, these students are frequent contesters in computer science contests, e.g. *International Olympiad in Informatics* (IOI). Such is the level of knowledge that little or no information presented in the course is new to them, thus we must raise the bar in order to keep their interest on the course.

As mentioned previous in this paper we require our students to develop a project and write the project's technical documentation in *LaTeX* (Latex project). Unfortunately, no more than 2 project hours are allocated for *LaTeX* teaching thus we require all our students to study *David R. Wilkins' LaTeX Primer* course (Wilkins). As an *integrated environment* for writing the documentation we advise them to use *ShareLatex* (Sharelatex), as it requires no installation of software and students can collaborate on the same document with ease.

For advanced students we advise them to follow *MIT's Practical C programming* course (MIT C) for further information. Although the course starts with the famous *Hello World* program, advanced topics are treated like *multithreading and concurrency* or *Linux inter process communication.*

Since *Python* has become one of the most used computer programming languages in the academia and industry (Programming top), we offer our advanced students the possibility to deliver their homework/projects in this language. We recommend learning *Python* from *Codecademy's* course (Python course) which offers and exhaustive introduction.

4 Future Work

In the future we plan to implement/develop/reuse a code tracking solution/system. The system must be able to track all the code written by the students for the course during the entire semester. With this raw data we plan do develop/reuse metrics that would give us a better assessment of the performance of each student during the semester. The scope is to use this system as an early warning mechanism for students that are not keeping the pace, thus we can channel more of our resources toward these students. The system should be tailored to show the amount of practice/work done by each student and possible bottlenecks.

The building block of such a code tracking systems is the method of storing student's code. As of this paper we are testing two possible solutions for code storing by the use of *Github* or Cloud9 online IDE (C9) together with an *Apache Subversion* (SVN).

The solution concerning only *Github* has the advantage of being easy to setup and manage by the teachers, as raw metrics can be easily obtained directly from *Github's API*. However, this solution is limited to analysing submitted versions of the code and we would not have a real clue about the amount of code/time/effort spent during the intermediary developing phases.

The other solution evolves getting information during the entire process of development by asking students to write their code using *Cloud9* online integrated development environment. All their work will be stored on a *Apache Subversion* server from where metrics can be extracted. Although this solution offers countless possibilities of development it implies time and monetary restrictions which we are trying to evaluate in order to reach a conclusion.

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Learning tools for virtual educational environment – implementation and solutions

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Abstract

The possible ways of learning process optimization in higher school by means of up-to-date learning tools which can be implemented into the virtual educational environment are analyzed in the paper. The brief review of the traditional and innovative learning tools is given. It is determined that utilization of Internet-available open learning tools contributes to the formation of professional competence as well as to the improvement of learners/future specialists professional skills. The issue of forthcoming educational technologies advent is considered.

Keywords: Learning tools, Virtual educational environment, Professional competence, Educational technologies

1 Introduction

Learning tools are the way of implementation of any education activity. Traditionally, material to be learned is mediated by the lecturer in the simple classroom environment. Students listen to the lectures in the lecturer's interpretation, try to understand the teacher's explanations, make some actions on the analogy. The usual learning tools available are the blackboard and the piece of chalk, flannel board, the slot board, pictures and picture charts, overhead projector, videocassette player, the textbook. The education process for students is fact-based and passive. The role of the teacher is the transmission of knowledge, students should be attentive listeners.

Nowadays the high school is a place where students acquire, create, integrate, and generalize knowledge through communication with lecturers and from other sources in the boundaries and volumes defined by the course program and additionally by the interests of the students. Course material will be learned by students better and wider if the communication comprises information that is meaningful to the student. Therefore, one of the most important way to improve the educational session is to strengthen students communicative and cognitive activity. The path to this goal is the use of noval learning tools in the classroom that promote activity of students, their motivation, expand the volume of material to be studied, facilitate the process of remembering.

Today's possibilities for the lecturer in the choice and utilization of the learning tools during the study course are really huge. Any lecturer can author his/her own learning course by defining learning objectives, creating content, choosing learning aids, and measuring learner's success through assessments in the cloud (e.g. in https://www.easygenerator.com) or in any other on-line or on-site virtual educational environment, by means of such learning and research resources as Cheat sheets, fast References and Quick Look-Ups, Guides and tutorials related to specific subjects, Quick start glossaries (e.g. http://whatis.techtarget.com), Real Science Labs online course (e.g. https://www.canvas.net), great number of on-line Quizzes (e.g. https://quizlet.com), etc. which immediately give the student not only simple and understandable directions for how to

perform tasks and exercises, but also an authentic lab experience as they investigate the scientific method, enrich them with experience in searching and utilizing of obtained information as well as test their knowledge independently.
That's why the answer on the question "*What learning tools should I choose for my lesson/course?*" is individual for every teacher but after the defining of course objectives and content it should be adequate to the subject and method of study.
The objective of this paper is to determine possible ways of higher school learning process optimization. The best way for this seems to be implementation of up-to-date education tools into the virtual educational environment that is shown on the example of foreign language learning aids.

2 Pedagogical tools for language learning – traditions and innovations
Education is the cognition of life and nature laws by scientific research through the experiments and practice, through the images embodied in scientific or literary works, as well as developing the students' ability to learn the essence of objects and phenomena in their distinctive features. The task of the teacher - to choose a path that will be the most representative for the study of the subject. Only a purposeful demonstration, which is accompanied by an analytical explanation, appropriate generalization, the formulation of the rules, the inclusion of this fact in the row of similar facts will contribute to such visualization in education process that will generalize abstract thinking and enrich the visual representation of an object or phenomenon, will direct students to the vision of the common law, to the analysis and creative processing of the material studied.

2.1 Visual, audio and audio-visual learning tools - psychological nature and value
Up to the later 50^{th} last century learning tools for language learning were exclusively of subjective character. Visual learning tools were widely used in the classroom for the study of vocabulary (new words semantization), because with the help of drawings the value of a number of verbs and other parts of speech can be easily explained. Thus, emerged the concept of learning vocabulary not by memorizing the list of isolated words, but by mastering the word in context. When entering a new word or notion the easiest way to do that was to show a picture of the subject (structure-oriented) and then some action (context-oriented) of this subject. By the way, the teacher himself is also the visual learning tool in such training – he/she can also demonstrate a great number of actions! (Palmer et.al., 1959)
The purpose of teaching grammar was to develop the students' skills and abilities of free use of language structures in real-life situations. "The study of grammar is not learning the rules or naming the parts of speech, but learning how to manipulate the devices that English speakers use to convey certain meanings and relationships" (Kreider, 1968). Visual learning tools were used in order to facilitate and speed up the process of mastering the language structures in conditions as close as possible to the conditions of real communication. Later had appeared specialized grammar visual material which specified the grammar rules of the studied language in acts of verbal communication, thus contributing not only to mastering of oral and written speech in the target language, but also to the assimilation of its grammar rules system. For this purpose the grammar structures sometimes were illustrated by means of multicolor tables or images (Hirsch, 1954).
All of the above became the basis for the study of visual material types – subjective and imaginative, due to their main task – to provide the development of students on the base of visual sense-impressions. But it soon became clear that only visual learning tools can't provide high-quality and fast foreign languages teaching.
"Sound brings language to life and life to language" (in Huebener, 1965, p. 140).These words of the a leader of the language laboratory movement, Elton Hocking, became the real motto for the next 25 years in the history of foreign language teaching. So, in the 60^{th} due to the rapid development of technical training aids, audio methods gain wide popularity in which the main

learning tool was a tape recording in the language laboratory (Allen, 1960; Hocking, 1964; Barrutia, 1967). We will not discuss the first language laboratories (1908) equipped with phonographic equipment (Leon, 1962) in this paper. It is only interesting to note that the first "phonetics laboratory" was installed at Washington State College in Pullman during the 1911–1912 academic year by Frank C. Chalfant. That lab also had a phonograph-recording machine and students could compare their pronunciation with the native-speaker models. But it was the 1960s when the real prosperity of this method had come. By 1965 only in the USA were about 6000 language laboratories in the educational establishments (Diekhoff, 1965).

At that time scientists did not have questioned the need to use language laboratory, which, as practice had shown, opened significant opportunities for intensification of education process, improving its efficiency. But more than 25-year history of the laboratories certainly indicated that a laboratory method is effective only in the specific conditions of narrowly focused courses. In all other cases, laboratory equipment provides a more efficient implementation of the methods of instruction that are defined accepted method of training, and laboratory works are included into the unified system.

The positive experience of the use of language laboratories allowed developing a concept, in which qualitatively different approach to the definition of the conditions necessary for the successful implementation of pre-speech and speech-creative exercises in the laboratory was clearly traced. In order to perform the pre-speech exercises it was enough to be ready to perform this type of exercise, but to perform speech-creative exercises the student must achieve a high level of language skills. If the level of skills is low, intensive training in speech activity without the guidance of a teacher will not benefit and may be even harmful.

In this regard, the search for ways of improving the foreign languages learning process effectiveness and new learning tool continued. We should consider radio and television as a learning aid, and their educational opportunities.

Radio and television in the 70th were by no means new learning tools. For example, BBC began its radio broadcasting in 1939 with six lessons called "Radio Teaches You English". In the 70-80th radio was used as additional learning tool in the classroom but it had some drawbacks for auditorium work. Students need to be taught different strategies for approaching various types of spoken material otherwise they don't understand neither transactional (listening to information such as a lecture) nor interactional (social listening); there is no possibility for repetition of the studied material, its clarification and communication (Brown et.al.,1983; Rybak,1983; Norbrook, 1984; Ur, 1984; Anderson et.al., 1988).

In the 80th educational television as a learning tool was very popular. Educational television programs depend for their effectiveness on their support materials and on the amount of preparation the teacher can do before the transmission. Some of them were specially designed for teaching foreign language (e.g. English).The intensive work afterwards was possible only in case of availability of written support materials, books or notes for the lesson. Nevertheless, television had great motivating power. Students saw language in context, which always makes it easier to understand. Some series were specially language based, and aimed to teach a particular syllabus. Television programs as a learning tool intensified the education process and made it more active (Christensen & Roberts, 1983; Anderson,1998).

The appearance of video-cassette players in the late 70th provided a more flexible teaching tool to assist different styles of learning. Some television courses were released also on video cassettes which became additional source of information for lecturers and students. Watching video cassettes during the lesson or at home motivated students a lot by showing how to cope with realistic tasks. Students could model their utterances on the characters they have seen on the

screen, participated in the role-plays and act out scenes they have seen, used the scene as a starting point for free practice (Lonergan,1984; Allan,1985; Tomalin, 1986).
As we can see the audio-visual learning aids had a great influence on the process of education in the second half of the 20^{th} century and played an essential role in the development of novel learning tools which should be adequate to the technological progress achievements at the beginning of the 21^{st} century. In the works of some researchers we can also find facts that audio visual technique had a tremendous positive feedback on the applied subjects. (Kalia,2015)
By the end of the 20th century a preparatory stage for the development and implementation of new learning tools was over and it was the Personal Computer that had become a pedagogical tool that combined all possible and even impossible learning tools, made real the dreams of the teachers of 50-90.

2.2 Next generation learning tools challenge – the shift in notions

According to Eaton (2010) the focus in language education in the 21^{st} century is no longer on grammar, memorization and learning rules, but using language and cultural means to communicate and connect with others around the globe.
The question of instrumental learning tools for this task implementation is considered to be solved today. One powerful device – personal computer can solve all problems which you had lately.
The teacher can visualized any subject and show its image to the students in ten seconds, the last generation digital (language) labs have wonderful abilities. They allow teachers to monitor, control, deliver, group, display, review and collect information which he/she needs for the lesson, audio, video and web based multimedia content is available worldwide, the student player/computer has Internet-connection and is linked to the teacher console, it can play audio, video and web based formats. At the lesson students can start, stop, rewind, record, fast forward, and repeat phrases or texts according to their needs (Roby, 2004). Your students can communicate globally with every place on the planet! They can play different games or participate in scientific projects all over the world.
But the students have changed themselves because they are the children of their time; they become more independent (Schofield and Davidson, 2003) and want to learn what *they* want by means of methods they used to and virtual worlds is the place that they are good acquainted with. That's why the appearance of virtual learning environments is a logical consequence of the digital revolution and their implementation to the training process is inevitable (Baidak &Vereitina, 2016).

3 Virtual education environment and its learning tools

Virtuality in education and science allows merging into the real physical processes and the processes of its simulation, penetrating more deeply into the investigated phenomena. But what learning tools should be laid down as a basis in the process of foreign languages virtual learning environment creation?
With the emerging of new approaches in the learning process (e.g. discovery learning - an approach to learning that can be facilitated by particular teaching methods and guided learning strategies. The term discovery learning refers to the learning taking place within the individual, the teaching and instructional strategies designed by the teacher, and the environment created when such strategies are used (Castronova, 2004)) requires notions of new learning tools. And now we can say that such learning tools are *knowledge, information and research* which can be obtained and realized only in resource-based computer-aided learning process. It means that so-called "ideal" learning tools are nominated as the main ones. Web-resources became the universal learning tool which can be used at every stage of educational process depending on the objectives and content of the course. We can even find today the list of Top-100 tools for learning

(http://c4lpt.co.uk/top100tools/ted-talksed/) in which you will see some accustomed for every student and teacher things, like You Tube, Power Point, Dropbox, Skype, Prezi etc. There are also some learning environments like Blackboard Learn (blackboard.com/platforms/learn.aspx), which abilities you can use for your own purpose and which will connect teachers, students and educational content. But usually such educational platforms are commercial, that's why universities and even separate lecturers try to provide their students with didactic training system that can be obtained through interactive e-books or virtual learning environments.

So, if you are going to create your own virtual educational environment, what learning e-tools should be utilized in it? To form the basic competences of students on the basis of pedagogical technologies of computer-aided learning process content components of the training process should perform linguistic matter and speaking skills that will be realized through the implementation of well-defined tasks and exercises. The principle of multi-functionality of exercises content and their motivated character should be taken into consideration. The didactic model of the lesson will include the programmed amount of material for study that is presented in the form of educational and authentic texts submitted in a format that allows listening, instant translation, hyperlinks, answers to questions, interactive tasks on mastering lexical and grammatical material including the possibility of correspondence, audio and video materials, control of listened/seen understanding, tests current and final control. What Web-resources the teacher will choose for this purpose – it depends on his/her creativity, on the objectives of the course and on the abilities of the students. But anyway the chosen learning e- tools should ensure high effectiveness of each student study during the course learning.

3.1 E-tools of the future – what are they?

We all like to watch scientific fiction films and to read such books. The tomorrows fate of education is clear – we all are moving to the e-learning and may be in some years it will be not necessary to go to schools at all – holographic teachers will come to every apartment and will teach our children.

4 Conclusion

Summarizing the above mentioned we can conclude that only interactive virtual learning environment that combines all possible learning e-tools for any discipline learning and teaching, including "Foreign Language" will optimize the educational process at each level of study because of the emergence of new strategies and by developing innovative learning technologies. Having equal rights with other components of didactic system, learning e-tools affect on the performance of the entire system, changing, adding and redirecting it.

With the emerging of new approaches in the learning process like discovery learning, competence and activity-based approaches learning tools should be also changed, appearance of such tools as knowledge, information and research and their utilization along with up-to-date e-tools will promote independent cognitive activity of student due to motivation of the learning process and the development of professional and creative personality of the future specialist.

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Designing and implementing the on-line courses at Ukrainian universities: Challenges and Perspectives

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Abstract

Although online learning is very relevant for Ukrainian universities, there are a lot of problems in the process of its implementing. The problems are connected not only with the technical aspect but also with the cultural one. At first, not all students and lecturers are physiologically ready to learn and to teach via Internet. At second, the old approaches widely used at Ukrainian universities do not suit the digital technologies and the way of transferring from the old to the new way of teaching is not always suitable. At third, the ways of controlling the quality of on-line education are not well-designed in Ukraine. And finally, technical support is rather poor in the majority of cases. Only a few problems of implementing the online courses were listed. Moreover, there are much more barriers that should be overcome. However, the conducted research proves the perspective and importance of online courses implementing for the increasing the effectiveness of the education at Ukrainian universities.

Keywords: On-line course, distance learning, quality of on-line education, on-line course structuring

1. Premises and objectives.

Modern period of the development of Ukrainian education is characterized by the influence of computer technologies. The implementation of the new education system, oriented to the integration of the country to the global information world, means accepting changes in pedagogical theory and practice on all levels. Computer technologies are too be oriented to becoming not something additional but an independent part in the education practice as well as the separate means of teaching with the purpose of increasing its effectiveness. On-line education started to develop in Ukraine not long ago. Before 2013 there were only separate approaches (experiments made by different universities) about distance and on-line learning implementation but there was no complex program and, what is more important, there was no official document proving the support of distance learning by the state. However, modern terms “distance education” and “on-line courses” come from the notion “correspondence education” which was a kind of external education quite wide-spread in Soviet Union period.

In April 2013 the Ministry of Education and Science of Ukraine adopted the law about the distance learning at educational establishments (secondary schools, universities and institutes). However, a lot of aspects left unclear including implementing and designing the courses, the ways of increasing the distance learning effectiveness and the quality of education. So, the aim of the article is to point the peculiarities of designing and implementing the online courses at Ukrainian universities.

To reach the pointed goal the following tasks should be solved, such as:

- To analyze the current situation with the designing and implementing the online courses at Ukrainian universities stressing the difficulties occurring during on-line studying;
- To present the structure of designed online course;
- To predict the perspectives for the on-line education pointing the psychological conditions of implementing them.

A great number of scientists were investigating the questions about on-line and distance learning: the development and content (C.Avdoshyn,. K.Korsak, S. Viller, V.Zinchenko), usage of the information technologies in pedagogical practice (Y.Pasichnik, P.Stefanenko); the designing of online courses (V.Rybalka, T.Oliynyk); the quality of distance learning (N.Mulina, V. Yakovenko); psychological aspect of on-line courses implementation (E.Isaev, M.Nazar); interaction of the participants of the educational process (O.Honchar, S.Komarov) and other aspects. However, the analyses of the theory only does not show the current situation with the distance learning implementing at the Ukrainian universities. To realize the challenges and the perspectives of the designing and using the on-line courses, the complex analyses of theoretical and practical bases and the experience of foreign universities in this field.

2. Theoretical bases

As M.Nazar points “on-line education” is the purposeful process accompanied by a formalized statement of achievements and conducted via Internet; the base of such education is the transferring the knowledge and information from on-line resources and the accepting them by the student [14]. The pedagogic theory considers the education as the communication between a lecturer and a student. (O.Honchar) [4]. In the context of on-line learning it is interaction which includes educational communication. As V.D’yachenko points the educational communication can be in pairs (the most wide-spread in Ukraine), front (one speaker and a number of listeners), collective (communication in small groups but different members all the time), group (the permanent group members) and mediated (communication without personal contact via Internet) [13].

As O.Honchar says ‘distance learning’ can be defined as focused interactive, asynchronous interaction between participants of education as well as with the means of education. The most important benefits of it can be: at first, the ability to communicate with a lecturer any time; at second, the student does not feel embarrassed asking a question not face to face; and finally, as students often prefer short advice than detailed explanation because it stimulates creative solving the learning objectives and gives opportunity to develop self-control.

The adopted law about distance learning points [9] that the aim of on-line education is providing educational services through the use of ICT for education or specific training levels according to state standards; training programs for citizens , foreigners and employees. The target group for distance learning in Ukraine according to the law is physical disable people, citizen of Ukraine who live abroad, those who are getting ready for entering the university, pupils who would like to get additional knowledge, pupils who live far away from educational establishment. This law gave definitions to the terms “distance learning”, “e-learning” and “online education” making them almost the synonyms with minimum difference in the used means of education.

The target group for distance education in Ukraine is mainly physical and mental disable people (according to the law). But actually the penetrated market here should be extended by:

- those who would like to increase their qualification or get additional knowledge on a certain field,
- students who can’t attend certain course because of work and prefer to have a distance one (but there should be limits for the number of distance course);
- those who are having internship or academic grant programmes abroad and do not want to miss a year.

Absence of the detailed explanation of the target group makes the process a bit confused. So those who can bring money to the university can not be sure whether they will be allowed to take the required course online or even will be given an opportunity to have this course. One more thing that a student should keep in mind choosing taking a distance course in Ukraine is the quality of education. Distance learning mainly means self-preparation work with the high level of motivation and responsibility. Not every student is ready for such kind of work. .

Based on the experience of the USA universities [12] about arranging the on-line education, the algorithm of conducting the online course should have a number of stages, such as:

- testing the personal qualities of a student (online);
- admission to the chosen course and accepting the tuition fee per course;
- pointing the tutor;
- making the individual academic plan to have credits,
- passing the control tests/exams (online or mixed);
- getting the certificate about the course; continuing the on-line education.

The main person in the online-education is a tutor who is considered to be an expert, an advisor, a leader. The directions of his activity are the following: projecting, consulting, facilitative and organizational. The professional functions of a tutor are managerial, diagnosis, motivation, planning, communication, controlling, reflexive and methodological [4].

3. Practical implementation

The first stage of the experiment (analytical) was conducted at 12 universities in Ukraine and 2 foreign universities (Germany). The next stage of the experiment (the implemented) was made at Petro Mohyla Black Sea National University, Mykolayiv, Ukraine. Based on the experience of this university, the structure of the on-line course “Management” as well as the advantages and disadvantages of its using will be discussed.

The course was designed for the second year students of Economic science faculty (specialization Finance and credit with the knowledge of English, language of studying is English).The course consists of 4,5 credits and contains 15 lectures (L). Petro Mohyla Black Sea National University uses Moodle so the course is a part of it. There are video lectures and power point presentations (PPP) to all topics; self-checking (SC) questions and tests to each topic are also included. There are 5 video webinars and teleconferences during the course. These webinars are aimed to discuss the unclear moments by the students. The on-line students are to apply for taking part in webinar so that the tutor knows the number of participants.

The course contains midterm (MT) and final exams (FE) as well as individual paper (IP) and presentation of this paper. Midterm is written after learning 7 topics. Midterm consists of short, long answers and case study. The time for midterm is proved both by the tutor and the student. The course moderator opens the access to the midterm and a student has 2 hours to complete it. Final exam is written after obtaining 15 topics and also consists of short, long answers and case studies; time for writing final exam is also 2 hours.

The next type of student’s work is individual paper which should be written according to academic writing standards and sent to the tutor before the deadline. Presentation is done based on the individual paper and presented to other students (mainly it is done on-line by different students and it is open for public; any person can register to see and then discuss the presentation).The presentation used to be sent directly to the tutor like the additional type of work but now the students make 10-15 seconds promo of their public speaking and upload it to the group of the conducted course trying to make the promo as attractive as possible. Other students evaluate the promo and according to the range the best three presentations are chosen. Then these people present the works during online conference. The public speaking can be seen and discussed not only by the listeners of the course but also by other students (it’s open). The listeners discuss and evaluate the presentations and send the feedbacks. The structure of the on-line course (based on the experience of Petro Mohyla Black Sea National University) is shown on the image 1.

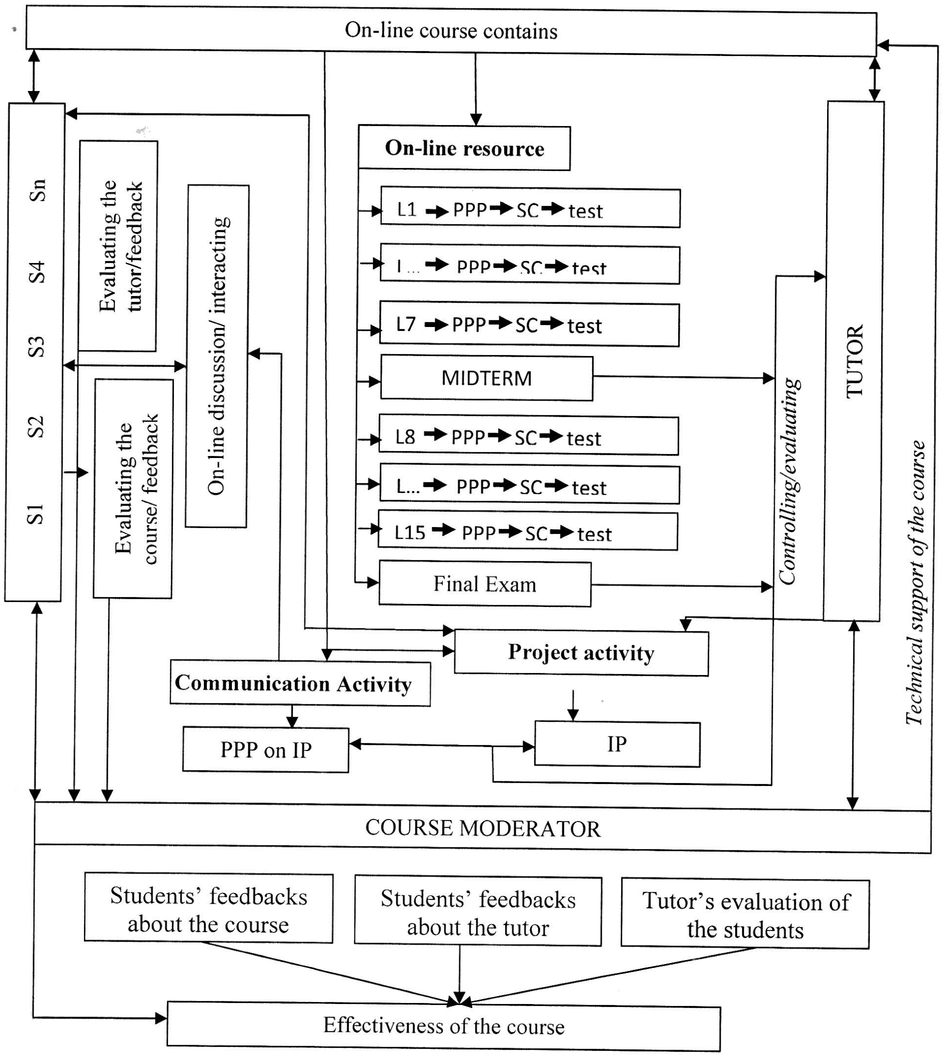

Figure1. Structure of on-line course (on the example of Petro Mohyla Black Sea National University)

As we can see from the image 1, the on-line course consists of on-line resources (the storage of all current, support and additional information which becomes available for the students every week), communication activity (aimed to involve students into online discussion of the presentations on individual projects /on-line conference, webinars), project activity (aimed to develop the creative skills of students and means interacting with students individually on-line) and control/ effectiveness of the course (consists of the analyses of students' feedbacks ad the students' evaluation by the tutor).

The effectiveness of the course is rather high (based on students' feedbacks). However, the level of individual papers and power point presentations remains not good at all. In individual papers the level of plagiarism is very high (almost 70%). So it is not an IP, it is work on copying and pasting the borrowed information without any analyses. One more problem is the question about cheating on exams. It happens quite often with full-time students and of course it is common for distance students. In Ukraine midterm and final exams do not show the real level of students' knowledge – only their ability to look for the information. Other negative moment is that the students mainly ignore the self-evaluation questions and tests. So their level of knowledge is lower than average. They have little knowledge of the course but would like to get "A" or at least "B"grade for the course and to gain the certificate. The validity of this certificate is minimum. Of course not all Ukrainian students are like that but because of the domination of such attitude and such behavior, the stereotype about the level of preparation of the Ukrainian students has been formed.

The main reason of the listed problems is the mentality difference (attitude to cheating, responsibility and success-orientation, trust in fairness, attitude to neglecting the rules / legal). One more thing that should be solved before implementing the online course in Ukraine is the support of the university as there can be: lack of the facilities, less than average level of technical providing and not always accepting the course by the university authority.

The difficulties of on-line learning for students and lecturers at Ukrainian universities:

- The existence of the psychological barriers of students and lecturers;
- Peculiarities of work and communicate using Internet;
- Perceptive processes of a person

To increase the effectiveness of the online learning positive environment should be created. The moderators of the distance education should pay attention to:

- The level of computer using awareness:
- The ability to present the information in the proper way;
- The existence the technical facilities;
- Modeling the education environment that expresses the necessary content presented by the educational resources of the Internet.

Peculiarities of on-line learning of the students at Ukrainian universities are the following:

- Increasing the level of self-support of students;
- Speeding the process of transferring the knowledge from internal to external forms;
- Increasing the level of searching skills; the analytical skills; the decision and conclusion making skills;
- The possibility to review the process returning to intermediate stages

Conclusion

The importance and relevance of distance education is evident. However, its implementation at the Ukrainian universities is not so good as it could be. The reasons of it are different, technical, personal and legal. The most complicated problem is the personal one. The attitude of students and lecturers to distance learning is a bit contemptuous.

At first, on-line teaching is the easiest and the most lightweight way of gaining education (as it is thought by the Ukrainian students). This stereotype is common both for Ukrainian employers and for students. The students consider this type of education to be a kind of so called "legal fake". In other words, a person pays money for the course and expects to be given a certificate without doing anything.

At second, the Ukrainian students got used to looking for excuses for not doing something and online learning suits it well. The name of this way of learning gives an excuse for not performing the task. The results of the research show that about half of students explain their not succeeding in the on-line course by poor Internet connection but not by their incapability.

And finally, implementing the online course into the education process at Ukrainian universities, a person should be ready for resistance from the side of the university authority as it demands extra efforts and expenses.

The advantages of implementing the distance education at the Ukrainian universities are the following:

- Interactive education – good cooperation between the participants of the educational process;
- Adaptability – provides the intensity of learning according to the wish of a student;
- Mobility and flexibility – such kind of education is available for everybody;
- Economically advantageous both for the university and for the student.

However, despite such visual advantages, the implementation of effective distance learning is occurring rather slowly. Such paradox can be explained by the disadvantages of on-line courses , such as:

- Low level of computer skills of both the staff and the students;
- Difficulties in designing the programs;
- Resistance of lecturers to change anything in their work;
- Mental and cultural peculiarities of the participant of the training as well as of the potential employers from Ukraine;
- Low level of the self-education skills, low level of motivation and self-control.

The article analyzes the current situation with the designing and implementing the on-line course at the Ukrainian universities. The general situation is not very good. But there's a positive tendency. New young lecturers oriented to the western approaches and with the European views to the education are able to enhance the importance and increase the popularity and effectiveness of distance learning.

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Aspects concerning the Employee Satisfaction and the Main Extrinsic Motivational Factors in the Organisational Environment

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Abstract

In contemporary life, in the organisational environment, the Employers face issues such as: professional satisfaction, personnel retention, the Employees' intention to leave the organisation and the phenomenon of frequent job change (job-hopping). In this context, the organisations are interested in identifying the true causes of such phenomena occurring and in influencing them, in order to obtain positive results, both for the Employee, and for the Employer.Employees are the most important resource in an organisation, and one of the most important internal objectives that the organisations have is to keep the best employees. Their degree and level of active involvement in reaching the strategic objectives of the Company they work for shall lead to attaining the performances the management expects.Numerous studies in the field list the work satisfaction as one of the performance predictors within organisations, and identifying the factors leading to the employee performance increase is a frequently encountered concern in Companies.Amongst the factors directly correlated to the satisfaction, this article focuses on motivation, namely on the extrinsic motivation.The objectives of this study aim, on the one hand, at analysing the relationship between work satisfaction, and extrinsic motivation, amongst the members of an organisation, and, on the other hand, at identifying the main extrinsic motivators.The used research method is the survey, and the used tool is the questionnaire. The subjects the questionnaires were applied to are employees of private companies, aged from 22 to 36, holding various hierarchical positions, of both genders, and who work in various industries (IT, financial and banking, telecommunications, and sales).The aspects concerning the data analysis and interpretation, as well as the research conclusions shall be detailed in the article.Given that more and more companies aspire to the status of "employer of choice", understanding the factors influencing the motivation is truly crucial in elaborating the strategies leading to the work and productivity increase, and to improving the Employees' results. The Employees' satisfaction and motivation are sensitive aspects, difficult to achieve in organisations, but, once the process is started, the more motivated and involved the Employees shall be, and the results expected by the Managers will not take long in making themselves visible..

Keywords: the organisational environment, the work satisfaction, extrinsic motivational factors

1 Theoretical Landmarks

Investigated by numerous fields of study such as economics, psychology or sociology, motivation and work satisfaction are the topic of multitudinous studies in the Human Resources literature. This is due to the fact that countless experts in the field believe that motivation and satisfaction can affect the labour market behaviour and influence the work productivity, the effort put in by the human resources, the labour force turnover or the absenteeism (Igret, 2012).

Lévy-Leboyer (2001, apudZlate, 2007) even thinks the motivation to be a decisive element of the organisation survival and an important trigger of competitiveness, which has now turned worldwide.

In this context, we think several short conceptual clarifications are necessary:

According to Gâf-Deac (2007), the motivation is an individual's interior state, which initiates and directs the behaviour towards a certain goal which, once it is reached, shall determine the satisfaction of a need, and the factors determining the motivation in achieving performance are internal (individual) factors: task perception; attitudes; needs; interests; behaviours; value system external factors: waging system; task definition; work group; control-supervision system; communication; feedback; spare time).

Other authors (Zorlentan, Burdus, Caprarescu, 1995) classify the incentives or the motivational factors as follows: economic (salaries, bonuses, profit sharing, etc.), orienting the behaviour towards performance and work, in general; psycho-intellectual or intrinsic (work satisfaction), showing the individual's personal orientation towards work; social or relational (friendship, affiliation to the group and team work, role and status), revealing the relational orientation towards work.

The work satisfaction is not just an indicator of the Employees' wellbeing and mental health, but also of results strongly wanted by the organisation, such as Employee turnover reduction, intention to stay within organisation, on-going improvement of the professional knowledge, productivity increase (Brown 1996, Egan, Yang and Bartlett 2004, apudIgret 2012).

Therefore, in the organisational context, the satisfaction has proven to be one of the keys to productivity and healthy, effective Employee operation, which is why it was thoroughly and lengthily researched.

The satisfaction level of an organisation member is linked both to a series of intrinsic, personal factors, but also to certain environment aspects. Amongst the latter, reference in this article shall only be made to the extrinsic motivational factors. Starting from these theoretical references, we initiated the investigation of these phenomena through the micro-research described hereinafter.

2 Methodology of the Research

2.1 Purpose of the Research

This study aimed at performing an X-ray of the motivation and satisfaction aspects at the workplace in the organisational environment.

2.2 Objectives of the Research

O1: To identify the connection between the Employees' work satisfaction level (measured through the STM questionnaire) and the extrinsic motivation level (measured through the FME questionnaire).

O2: To identify the main extrinsic motivators correlated to the work satisfaction level.

2.3 Hypotheses of the Research

H1: There is a significant statistical relation between the Employees' work satisfaction and the extrinsic motivation level.

H1.1: There is a significant statistical relation between the work satisfaction and the material and financial extrinsic motivational factors.

H1.2: There is a significant statistical relation between the work satisfaction and the extrinsic motivational factors related to the work and its conditions.

H1.3: There is a significant statistical relation between the work satisfaction and the extrinsic motivational factors from the work group category.

H1.4: There is a significant statistical relation between the work satisfaction and the extrinsic motivational factors from the area of the relationship with the hierarchical superiors.

H1.5: There is a significant statistical relation between the work satisfaction and the extrinsic motivational factors related to the workplace stability.

2.4 Sample

The sample the research was performed on consisted of 30 private company employees. The industries they operate in are very diverse, just as the departments they belong to or the hierarchical positions they hold. Thus, the Subjects included both people holding management positions, and people holding executive positions. The Subjects were aged from 22 to 36, and they are all university graduates.

2.5 Used methods and instruments

The used method was the inquiry. The instruments used in this research paper were the questionnaires (“Work Satisfaction - STM” and “Extrinsic Motivational Factors - FME”), in order to measure the Employees’ satisfaction level at the current workplace, and to identify the dominant extrinsic motivational factors. The “Work satisfaction - STM” questionnaire shows the general satisfaction level that the Respondents have concerning their work, and consists of 12 items. The “Extrinsic Motivational Factors - FME” questionnaire identifies the extrinsic motivation level in relation to 5 dimensions, consisting of a total of 17 items, as follows: The material and financial factor (Items 2, 4, 8, 17); The work and working conditions (Items 5, 14); The work group (Items 3, 7, 9, 12); The relationship with the hierarchical superiors (Items 1, 10, 16); The workplace stability (Items 6, 11, 13, 15).

The questionnaires were administered online. The Subjects were asked to pick a number from 1 to 6, for every item, depending on the how true the statement was for them. Thus, 1 equals to total disagreement to the statement, while 6 - to the total agreement.

2.6 Data Presentation and Analysis

The data were processed using the SPSS software.

The research results statistically confirm the H1 hypothesis: There is a significant statistical relation between the work satisfaction level and the extrinsic motivation level. There is a positive, direct correlation between the two main research variables.

The psychological contract theory supports the fact that the Employees formulate certain beliefs concerning the types of resources they are bound to offer to the organisation and that the organisation is bound to offer to the Employees in its turn (Robinson & Morrison, 1995).

The Employees conclude a psychological contract with the organisation they belong to, based on the resources they were promised and on the obligations which are also communicated by the organisation, and implicit to the norm of reciprocity. Therefore, the fact that this study revealed a correlation between the work satisfaction and the extrinsic motivational factors might be due to the existence of such reciprocity.

Furthermore, the study results also confirmed the sub-hypotheses. There is a direct, positive correlation between the work satisfaction and the sub-variables - factors of the extrinsic motivation.

The results obtained from the FME questionnaire revealed the extrinsic factor concerning the relationship with the hierarchical superior to be the most important one, with an average value of 5.2 points out of the maximum of 6, 0.7 point away from the next motivator down - the work group (see Figure 1). The salary factor scored 4.3, while the working conditions and the workplace stability scored an equal 3.8.

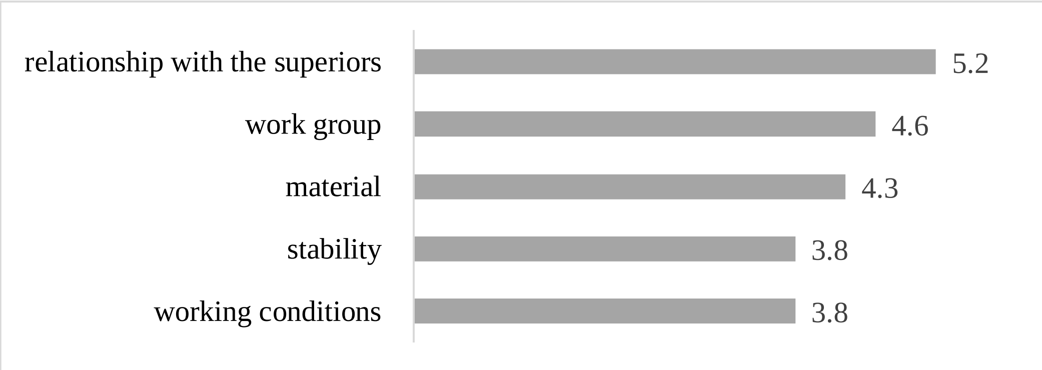

Figure 1. Scores computed for extrinsic factors

2.7 Data Interpretation

The data interpretation was performed starting from the factors listed hereinabove.

It is well-known how important the direct superior is for the workplace environment quality and Employee motivation. Usually, the Managers who encourage the Employees, supervises them, but also ask for feedback, and take their concerns into account, are the most successful, because this keeps the Employees happier and more motivated.

The direct coordinator's activity in managing the organisation member's motivation level can lead to performance increase on the short, medium and long-term. In order for this to happen, it is important that the actions be consistent and the solution-oriented attitude be maintained. Certain effective actions can be oriented towards improving the Employees' abilities and mind-set. This approach is based both on the company interests, and on the development interests, and Employee potential. More concretely, this can be achieved by organising courses and trainings, knowledge-sharing sessions, involving the Employees in challenging projects. Besides these approaches, it is also important that the superiors express their appreciation for the Employees' good results. Starting from the positive feedback, up to granting rewards, the coordinators can make many appreciation gestures towards the Employees.

As concerns the relations at the workplace (the second motivator according to this study), a study is described in the specialised literature, performed over a period of 75 years, and following the lives of over 700 persons, which made it the longest study on adults' lives ever performed. Robert Waldinger, a psychiatry professor at Harvard Medical School, is the fourth coordinator of Harvard Adult Development Study, and the conclusion he reached according to the study is the following: The social relations are beneficial for us, and loneliness kills. "It turns out that people who are more socially connected to family, to friends, to community, are happier, they're physically healthier, and they live longer than people who are less well connected", highlights Waldinger. Dr. Waldinger found a similar pattern concerning the friendship relations to the people around us. People who worked to replace their old work colleagues with new friends after they retired were happier and healthier than the ones who left their workplace and placed focused less on maintain strong social relations. The Harvard Professor admits that the research shows there is a correlation between the processes, and not necessarily a causal connection. Therefore, it is not surprising that the work group and the workplace relations were revealed as the second important motivator.

The third motivator revealed after the questionnaire was filled out is the financial factor. Although it is an important motivational factor and it can influence the work satisfaction, it is not one of the strongest. Examples from the managerial practice prove that, if the relationship with the

Manager or with the team is not satisfactory, the Employee may decide to leave the organisation, even though the salary level is satisfactory. The studies show that the financial compensation effect is very shortly-lived. 75% of the Employees forget the received bonus or commission value within no longer than 30 days. The first bonus acts like a drug and it has temporary effects, but over a longer period of time it makes the Employees stop working unless they receive financial bonuses, so, more and more money. Moreover, on the long run, the financial bonuses make the Employees unhappy and start competing with their colleagues. Money is perceived by the Employee as an entitlement, and its motivational effect is more based on the fear of loss rather than on the wish to better do their job. That is why the effects of the financial motivation can only be strong so long as the granted amounts of money exceed the normal by far. The fact that financial rewards came only 3rd in our study may show, on the one hand, a high level of self-awareness on behalf of the Respondents or, on the other hand, a current satisfactory salary level that they have.

2.8 Conclusions of the Research

The objectives of this study aimed, on the on hand, to identify the potential connection between the work satisfaction and the extrinsic motivation amongst the members of an organisation, and, on the other hand, to identify the main extrinsic motivators. As the data interpretation also reveals, there is a positive correlation between the work satisfaction and the extrinsic motivation. As regards the identification of the main extrinsic factors, the research offered us an overview of the first 3 motivational factors perceived by the Respondents as being the most important, namely: the relationship with the hierarchical superior, the work group/team, and the financial aspect.

One of the most important research limits is the low number of Respondents. At the same time, a variable that the study failed to investigate, and which might have revealed further information is the seniority at the workplace, the type of organisation the Employees belong to, as well as the type of the professional role they hold. Another element which might have led to a lack of correlation is the Respondents' age (the X and Y generations). The studies show major differences between generations as regards the motivation. If the Y generation Employees want to have an interesting, dynamic and challenging job every day, the Employees of the X generation want to have a stable workplace and a management they can trust. All these variables may lead to effects that this research could not control. In other words, the control of such variables may lead to reaching results with a higher validity level.

As the analysis of the main extrinsic motivators showed, the Employee is motivated by a good relationship with the superior, by stability or by the working conditions, and when such needs are not met, the satisfaction level related to the professional activity may be very low. What the following studies can focus on is the increase of the participant sample, and/or the use of other research methods, complementary to the questionnaire.

Conclusions

It is obvious that the Managers' continue to focus extensively on the hygiene factors (salary, bonuses, working condition, etc.), which do not create long-term satisfaction. If a Manager wishes to have happy Employees, who want to permanently increase their performance, then they must place their focus on the motivators, the only ones that may ensure the success of such an approach.

An effective management must find a balance regarding the Employee satisfaction, a balance which, on the one hand, may not allow the individual or collective performance to be affected by an acute dissatisfaction, and, on the other hand, may stimulate the performance by finding effective ways to increase the Employee satisfaction.

Therefore, the Human Resources motivation reads as motivating the people in doing their activity. It does not mean, first and foremost, to repay them financially, but to improve their mental/social representations regarding the work, the organisation where they work, and the product resulted from the respective activity (Craiovan, 2006).

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Exploring New Learning Tools within the Department for distance learning of the University of Bucharest

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Abstract

The acronym DDLUB will be used to identify the Department for Distance Learning of the University of Bucharest, Romania. From its foundation, the DDLUB was continuously focused on promoting new technologies in education. A remarkable initiative was the implementation of GAFE and Google Classroom platform in order to support the communication and collaboration between academic staff and students. In recent years, the authors focused their resources in selecting and implementing the new resources and trends in the educational process (their own initiative). From this point of view can be pointed out: platforms for blogs (ex. Google Blogger) , educational games applications (ex. Scratch), platforms for creating on-line courses (ex. Udutu). All these resources have been used both to communicate with students but also to teach them how to use it, to discover the advantages and limitations of an e-learning tools. It this paper we will focus our attention on debating the main issues concerning the use of games in the learning processes and its role in supporting pedagogies in the digital age. We know from experience that rich media enhances the learning experience, so we've set up games (learning students to use and build educational games) as a part of our learning process goals. It will be presented a case study developed by the authors, in the academic year 2015-2016 in which they used a free games platform that allows students to build educational games using the pre-designed templates or exercise complete autonomy in creating games the way they want it.

Keywords: e-learning, educational games, online.

1 Engaging with new resources and trends

Erika Anderson said:"The essence of developing a successful vision is not only envisioning a possible successful future but also articulate it in a way that's both compelling and inclusive" (1). From this perspective when facing the challenge of making a change in the way you teach or the tools you use to get to your students it is important that the process of selecting and implementing to be both compelling and inclusive and you have to have a perspective of the process on the long way.

Global trends indicate that our educational future is strongly marked by the implementation of new technologies in the educational process. Implementation of these technologies it starts at the primary levels to the academic level. But studies show that in the field are more studies on this topic relocate the primary and secondary level and less at the university level.

Matt Wallaert, behavioral scientist at Bing.com says that "Introducing technology into a rigid environment is not going to suddenly open up a world of possibilities" (2).

In Romania, academia reacts in a slower way in adapting these new technologies, for various reasons: socioeconomic factors, resources, knowledge and budget.

A short survey shows that most teachers say they know how to use new gadgets, but an analysis of this result makes us say that there is a considerable difference between knowing how to use a power tool and integrate the new tool in the educational process. Moreover, with the rapid development of technology gadgets, we can say that a large number of teachers need training on the integration of new technologies in the educational process and the selection of the best tools to use in the classroom taking into consideration the class particularities.

Eady, M. J. & Lockyer, L. (2013) in an article regarding the new technology and teaching strategies make a few suggestions for teachers that consider the possibilities for embedding technology into teaching:

1. Understand the role of technology in education.
2. Identify technological applications and resources used in classrooms today.
3. Be aware of how you might embed technology through a range of teaching and learning strategies. 4. Evaluate technological tools to support teaching and learning.
5. Understand possible challenges and barriers you may face as a new teacher using technology.(3)

2. The teacher's dilemma: when, how and what new technologies can be used?

2.1 Working in “the cloud”

As a teacher of the XXIst century you have to “win” a new type of student for your classes - the always online student, always on move, so you must permanently adopt and organize your classes to be in the same place where your students are - online.

The process of exploring new learning tools was conducted with students in the first and second year and at the Faculty of Psychology and Educational Sciences, courses in Information technology and Computer assisted instruction.

The approach that Professor Bogdan Logofatu chose for both courses was a modern one, aligned to global trends, a blend of traditional lectures, online learning resources and a lab activity to enhance student learning in an interactive manner.

Students in the first year they were presented general concepts about information technology, the latest tools used in universities around the world as well as global trends and also future work skills.

The activity was divided in two: course hours and laboratory activities.

During the class hours were defined and clarified key concepts about information technology (learning management system, cloud computing, etc), were provided online resource (courses materials, related links, video presentations for Google Apps for Education platforms - that were to be used as communication channels) and in the laboratory activities the students were taught to use Google Drive tools (Google Docs, Google Presentation, Google Forms) as a modern alternative (related to the concept “in the cloud”) to Microsoft Office.

From our point of view, learning to work with the tools in the cloud, offers students the advantage of developing computing skills. The demand on computing skills comes from all areas, from businesses to the public sector, so, it offers our students multiple choices of disciplines, experiences and careers.

Laboratory activities were a cross between transmitting and explaining concepts and information and practical activities on applications.

Each laboratory, students had received a task that was made under the guidance of the teacher. The tasks were loaded via a virtual class (using Google Classroom). Each student has achieved the requirements at their own pace under the guidance of the teacher. The requirements could be made either being physically present in the computer lab or online from anywhere.

The practical activities were subsequently verified by the teacher and were added suggestions / comments where demands were not met fully or correctly.

Why do we choose to take the courses as a blend? And why we choose to work with students in the clouds? Well, we had in mind the students learning outcomes that we established for the course. To get there students need to work hard (learning new concepts and what’s the impact of

new technologies on society), they need to be creative, motivated (and that task we believe was achieved through the permanent feedback provided by the teacher) and inspired (through the related links, examples provided by the teacher or other colleagues).
The technology represents only a tool but if the student has acquired skills and behaviors then we can say the courses were a success!

2.2 Learning students to create their own educational games
Having the experience from the first semester with students from first year, on the second semester, our attention was focused on educational games. When choosing this approach we have taken into account the target group we address. Considering that students will be teachers in primary and preschool, creating their own educational games can be a great advantage.
To touch our goals we choose a free online platform developed by MIT (Massachusetts Institute of Technology) - Scratch.
Scratch is used in more than 150 different countries and available in more than 40 languages. As it can be seen on their official site ”Students are learning with Scratch at all levels (from elementary school to college) and across disciplines ... the students can use Scratch to code their own interactive stories, animations, and games.
In the process, they learn to think creatively, reason systematically, and work collaboratively - essential skills for everyone in today’s society” (4).
The platform allows you to create a teacher account so you can create student's account and manage your class activities.

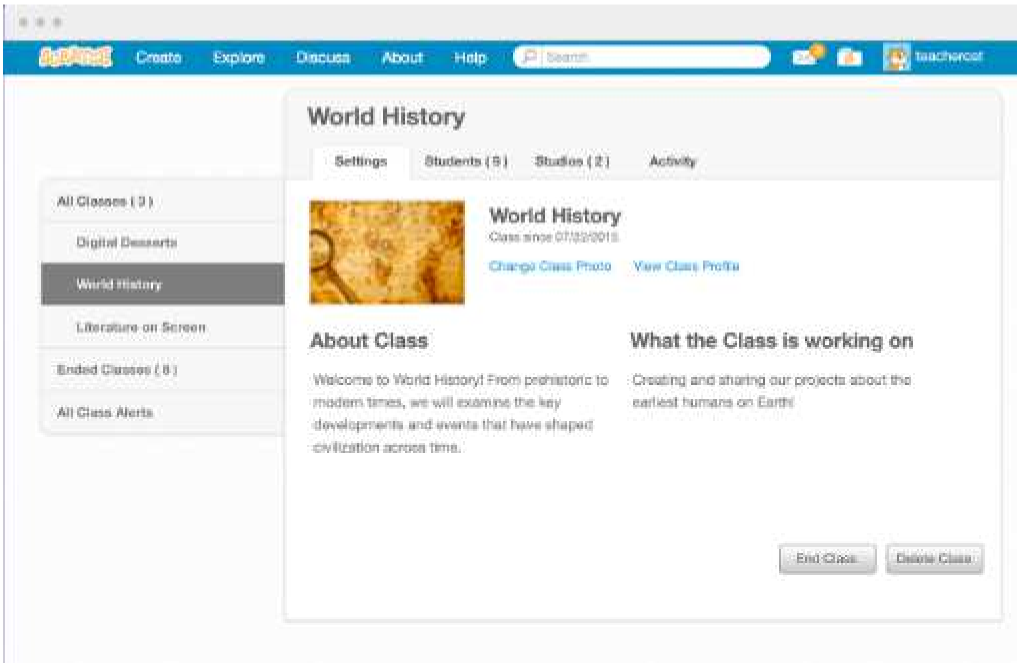


Figure 1. Print screen - teacher dashboard on Scratch
(https://scratch.mit.edu/images/teachers/teacher-account.png)

As we have already mentioned the courses were delivered through a mix of lectures, tutorials, case studies and project work. The theoretical aspects that concern the definition and delimitation of the concept of gamification were discussed in the classroom. Then, were also analyzed the advantages

and disadvantages of using games in the educational process .Based on the theoretical aspects from the class, in the laboratory, the students had realized the first games The students received guidance in person (from the teacher) but have also been made available a series of video tutorials that guide them through the process of creating the game (the videos were registered by the teacher - presented in figure 2).
If a picture is a thousand words, than what is the value of a video? Instructional tutorials can make information come alive in the minds of students.

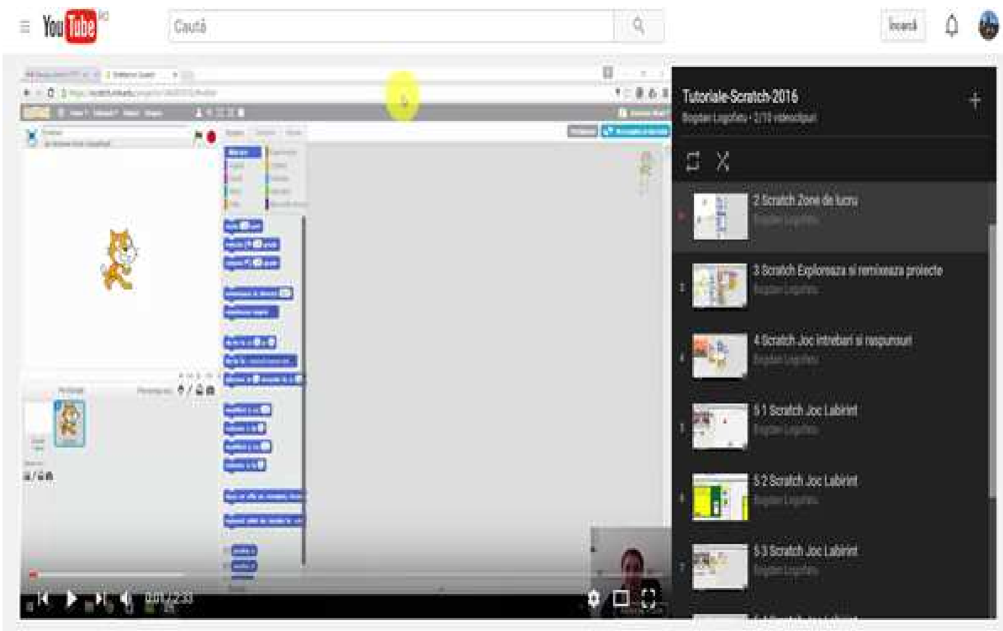
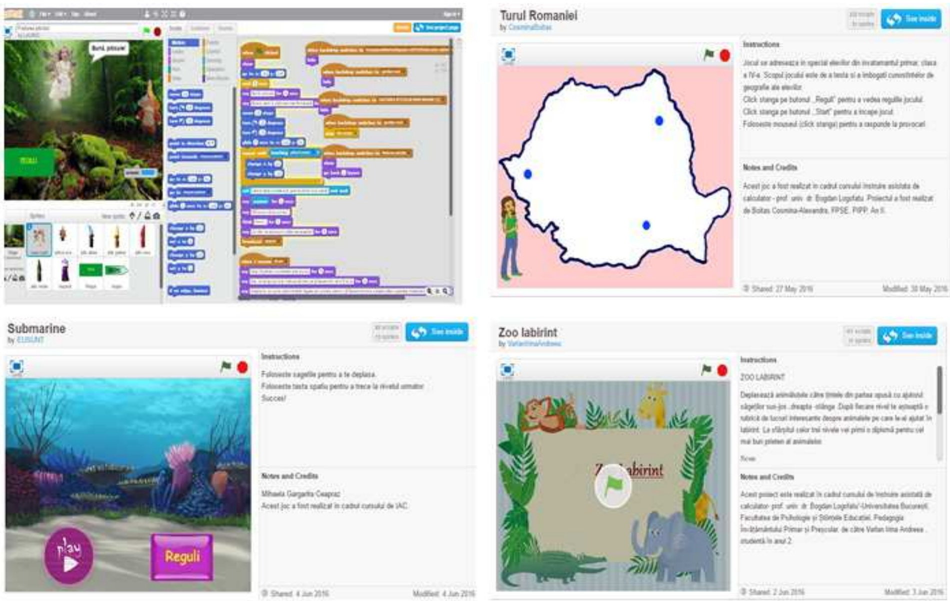


Figure 2. Print screen - video-tutorials Scratch
https://www.youtube.com/channel/UC4NWVpEDo1rX5e1Nj1svsBw

Regarding the actual implementation of projects, the students received a series of recommendations but also the criteria and rules which should been taken into account in creating their projects. The first aspect they had to clarify was the target group. The characters in the game and the difficulty level should be adapted to the target group. Each of them had the option to build their project from starting point or customize (by mixing) projects created by other students.
That way we allowed students to build educational games using the pre-designed templates or exercise complete autonomy in creating games the way they want it.
Their games had to be mentally productive. So, the project had to have different levels so you can progress and pass to a higher level, or to resolve a puzzle.
One of the ultimate goals at an educational game is that at the end, the player should mastery some skills, or to understand the relationships between different subjects because no matter what the subject mastery depends on understanding how details fit into the whole.
At the end the students' project were analyzed by the teacher. The results were satisfactory. Even if not all students were very involved in making games, they took into account the recommendations given during the semester.
Some games had medium level of difficulty while others were extremely complex , with well-defined characters and a complex story of the game .



As Mitch Resnick said: “The ability to code computer programs is an important part of literacy in today’s society. When people learn to code in Scratch, they learn important strategies for solving problems, designing projects, and communicating ideas” (5).
Learning how to program is like learning any other language in that the skill must be practiced and tested out. Just as languages open up the ability to communicate with worlds of people, programming gives students the ability to create technologies that could have immediately impact on their future class activity (6).

3 Conclusion

The conclusion are simple:
1.Programming is a basic literacy in the digital age.
2.There are countless skills that students can develop such as critical thinking skills, creativity, teamwork.
3.Computational thinking is a skill that everyone should learn. It will help students understand and mastery technology of all sorts and solve problems in almost any discipline.
4. A new computer science curriculum should be introduced into schools.

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Modern aids in teaching design

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Abstract

Aims of this paper are to present ICT facilities for teachers to help in preparing of lesson. Teaching design is a specific teacher activity and consumes a long time after school, on home. In school are two modalities for using computer: as work tools for student or for teacher (presenting the information as text documents, posters, graphic representations, video, experiment modelling, pictures, calculator, tables; achievement and use of data bases, in laboratory experiments for realization, simulating or completing of the experiments). On the other hands, as didactical tools: direct mode - computer acting as support for teaching (educational softs, Computer Assisted Instruction); indirect mode - computer controlling and planning the training, thus taking over the duties of the teacher.(Computer Managed Instruction). In the paper is presented how the computer helps and assists the teacher through an online platform. Learning Design is a platform that makes available a suite of tools that eases didactical design. Advantage of this is that teacher can summarize the lesson plan, insert various resources, has a map of the time, of the unit of learning and of learning aims.

Keywords: Teaching Design, on-line platform, lesson plan, unit of learnning

1 Introduction

Considering the importance given by the European documents to digital competences development, numerous studies conducted in recent years in the country, were performed quantitative or qualitative researches regarding access to teachers and pupils to cutting-edge technology and their perception of the the use of computers and other devices and materials format electronic. Studies accomplished at an interval of decade have shown a permanent interest of the Ministry of National Education to improve this aspect.

The network of european policy regarding the key competences – KeyCoNet was lanced in 2012, with goal to analyze and identify the needs in educational system specific for every country. Open Educational Resources for teachers are facilitated at European level by European Schoolnet Academy - a oficial online platform dedicated for learn about innovation in the school and classroom through online professional courses for teachers in pre-university schools. The network was funded by the Lifelong Learning Programme of the Directorate General for Education and Culture, European Commission.

Through European Schoolnet Academy, the Institute of Education, London Knowledge Lab promote Learning Designer platform.

2 Learning Designer platform

Teaching design is a specific teacher activity and consumes a long time after school, on home. In school are two modalities for using computer: as work tools for student or for teacher (presenting the information as text documents, posters, graphic representations, video, experiment modelling, pictures, calculator, tables; achievement and use of data bases, in laboratory experiments for realization, simulating or completing of the experiments). On the other hands, as didactical tools: direct mode - computer acting as support for teaching (educational softs, Computer Assisted Instruction); indirect mode - computer controlling and planning the training, thus taking over the duties of the teacher (Computer Managed Instruction).Through Learnig Designer, teacher following Computer Managed Instruction.

The Learning Designer site represent a suite of tools planning for teaching design, that enables also teachers to share their good teaching ideas. It is meant to help a teacher to see other pedagogic approach for different topics. Teacher can project own lesson or can see other designs as example, or inspirational resources.

Every teacher knows that is dificult when planning a unit! This tools covers the most important details of a whole unit, lesson by lesson or single lesson. It's a easily way to organize all details for moments of lesson.

Platform has tow menu: Browser and Designer.

2.1 Browser Menu

Browser' give a collection of pedagogical patterns, which can adapt for own teaching practice. (fig.1)

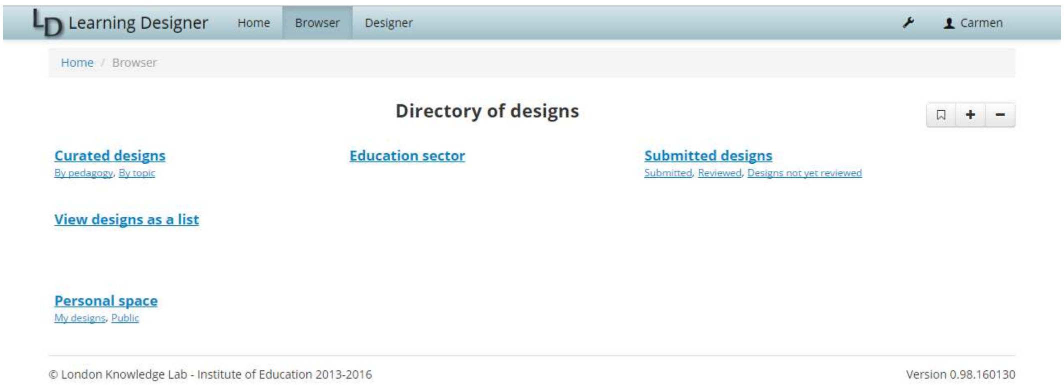


Figure 1 Directory of designs

Curated design is organised into four section: 1. By pedagogy: Collaborative learning, Constructionist learnig, Discussion-based learning, Game, Inquiry-based learning; 2. By topics: Any or all topics, Art History, Business, Computing, Education, Environment, Grammatica, History, Italiano, Letteratura italiana, Mathematics, Research methods, Science, Sociology, Sport, Technology, TESOL; 3. ECMA and 4. Online/ Blended Designs.

Education Sector: CRAM Workshops, Learning Designer Workshops, Mathematics, Suitable for any sector, Suitable for Higher Education, Suitable for Primary Education, Suitable for Secondary Education, Vocational Education and Training.

Submitted Design: Designs not reviewed yet, Ecole de soins infirmiers, Reviews, Submitted, Users' public spaces.

View designs as a list

Last is Personal space

2.2 Designer Menu

Designer menu presents the pedagogical pattern template to help teachers on scheduling own ideas for plan of a teaching-learning unit. (fig. 2)

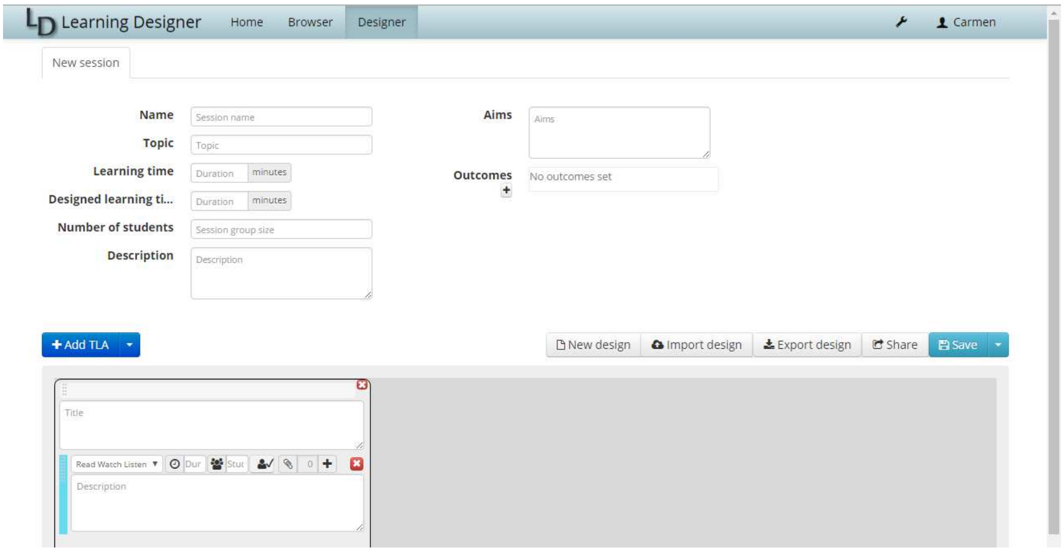


Figure 2

In Name caset, teacher write the Title of lesson or Title of unit learning. On Topic can be discipline, the theme or the Chapter. One after one the teacher completes the boxes with learning time, designed learning time, number of students description, aims and outcomes. For Outcomes, the platforme has a library with categories from the Bloom Taxonomy. Next step is to project Diagram TLA : title of lesson, moment of lesson (Read Watch Listen; Collaborate; Discuss; Investigate; Practice; Produce), dedicated time, number of student, if teacher present or no, resources attached, attach resource.

Every specific moment of lesson has one colour: Read Watch Listen – light blue; Collaborate – yellow; Discuss – blue; Investigate – red; Practice – purple; Produce – green. If are project an unit of learning, it can project for more lessons and must multiple diagram TLA with 

 button.

In right of board are designer a Diagram Pie with lesson plan. Teacher can memorize on site various resources as in figure bellow. Finally must save the work.(fig 3)

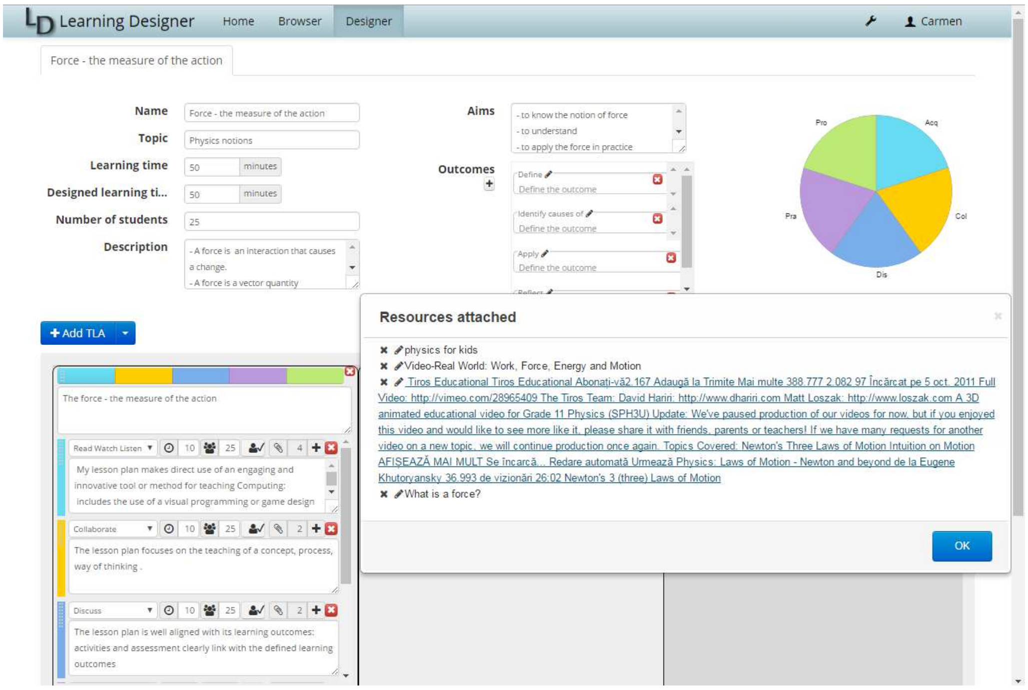
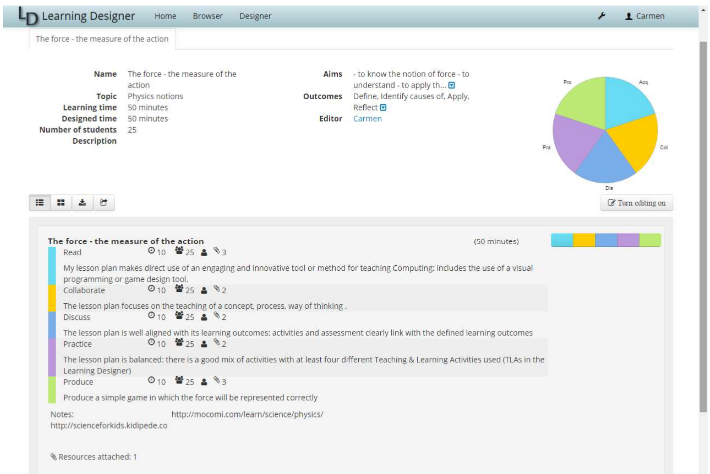


Figure 3

On-line teaching Plan can be visualized through List View - box (fig. 4) or Block View - box.



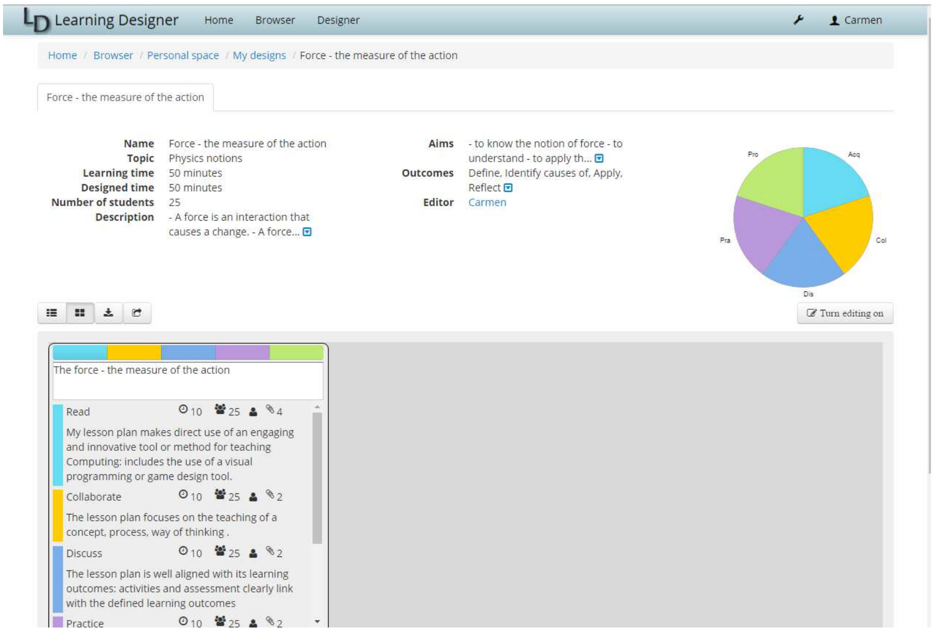


Figure 4 List View; Block View

By command *Export this design* , teacher has the lesson plan or the learning unit plan as Word document. If must change or modify everything will access Turn editing on Turn editing on.

3 Discussions and Conclusions

In schools, information technology and communication (ICT) can be more than a means of education it can be also a tools for teachers; can become a concept that can make radical changes in the teaching design and has a significant potential to improve the quality and standards of performance of teacher in the educational process.

Professional development programs for teachers via European Schoolnet Academy provides technology-rich experiences throughout all aspects of the training.

Computer helps and assists the teacher through an online platform. Learning Design is a platform that makes available a suite of tools that eases didactical design. Advantage of this is that teacher can summarize the lesson plan, insert various resources, has a map of the time, of the unit of learning and of learning aims. Learning Design is a powerful aids for teacher and for teaching design.

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A Didactical Analysis of Math Online Games for Primary Education

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Abstract

Digital learning games belong to the types of software that almost all European countries promote, Romania not being a part of them (EACEA P9 Eurydice, 2011). Because of this, Romanian teachers do not have validated digital learning games for training. Yet the need for such games is felt not only by the teachers, but also by students or parents. In this article we make an analysis of existing online math games for primary education in Romanian language. General finding which was spun off in the analysis is that many of the online math games do not meet the pedagogical requests and even if the topics addressed arouse children's interest, they only rarely develop certain skills. On the other hand, in most cases, we cannot have such claims because the sites do not maintain that the games they promote have an educational purpose. There are, however, some examples of good practices that are presented in the article and can be the starting point in the development of truly valuable online math games. This includes games made for CDs that are well designed in terms of items you need to find in a teaching game.

Keywords: On-line games, mathematics, primary education

1. Introduction

According to Vlada, Albeanu & Adăscăliţei (2015) the term of "virtual learning/education" is not replacing traditional education forms and ways to eliminate the role of teachers in the teaching process, but the contrary should represent forms and modern ways to achieve a higher level the teaching-learning-assessment through ICT. In the European Union almost twice as many students browse the Internet for fun than for schoolwork at least once a week (83 % and 46 % respectively) (EACEA P9 Eurydice, 2011. *Key Data on Learning and Innovation through ICT at School in Europe*). This is only one reason for what the great majority of European countries recommends or suggests several innovative pedagogical approaches that may be effectively enhanced through the use of ICT with the aim to increase students' engagement and improve their results. One of these pedagogical approaches is the online learning (see figure C1, p. 43, EACEA P9 Eurydice, 2011). According to the same sources, the official documents from Romania do not provide recommendations, suggestions or support for teachers in this direction. Digital learning games belong to the types of software which almost all European countries promote (see figure C2 p. 45 EACEA P9 Eurydice, 2011). Based on these general observations, in this article we make an analysis of online math games for primary education in Romanian language, a subset of digital learning games, in order to see on what extent they can be integrated in the teaching-learning-assessment of mathematics.

2. Pedagogical considerations on online games

Educational offers' diversity and significance of the new technologies of information and communication increasingly bring in the spectrum of the playful activities digital games. These games have the advantage of being able to be accessed at any time and through any means (PC, laptop, tablet, phone, etc.). They represent a category that came from the need of release of certain mental energies, the need to relate to each other, regardless of the limitations of a geographic area. Educationally, M. Prensky (2001) coined the term Digital Game-Based Learning (DGBL). Online games are a subset of digital learning games "that is either partially or primarily played through the Internet or another computer network" (Rollings & Adams, 2006). The interest in online games is because of the easy access to them and also for the purpose of the electronic teaching communication finalities which properly complete written and oral teaching finalities.

At the level of electronic teaching practice existing in the school there were already identified some advantages and limitations (R. Răduţ-Taciu, M.-D. Bocoş, O. Chiș (eds.), 2015, p. 415). A. Adăscăliţei (2007, p. 57) shows the basic structure of the games for computer training.

At the level of electronic communication management, we identified the following pragmatic landmarks, which can be explained by reference to online games (see table 1).

Pragmatic highlights in the management of electronic communication	*Explanation:*
- using phrases, sentences - with limited extension - in the transmitted instructing	- using short phrases, to coordinate as accurately the player's action
- ensuring accessibility and message comprehension	- using adequate words and semantic fields accessible to the receptor, in his/her native language - avoiding specialised computer terminology - rational limiting of the individual symbolism field - avoiding exaggerated abbreviations - dozing the use of emoticons; correlating them properly with the written message which strengthens and nuances them
- ensuring the clarity and accuracy of message	- respecting scientific accuracy - careful building of messages using clear and unambiguous words and phrases - avoiding confusing information, redundant or unnecessary words, expressions of oral language, elements of slang / familiar language (they can generate language barriers) - using affirmative expressions, preferably
- using messages appropriated to the context and recipients	- taking into account the characteristics of the communication context, the velocity of information, the handset psycho-individual features of the receiver and reporting them to the finalities proposed in the communication process - taking into account the psychosocial particularities of the partner micro group in communication
- using relevant and effective messages	- respecting the linguistic correctness - practicing critical attitude in message design - encouraging critical attitude in the receiving and decoding of messages
- harnessing the formative and informative valences of the message	- using words loaded with affection - exploiting the possibility of building playful connotations which increases the involvement of the preschooler / pupil in the game - enabling the creation of a perceptive multi-modality, by coherently articulating the image, word, color, sound and dynamics in composite representations

	- stimulating cognitive interest and desire for knowledge - developing the capacity for abstraction and synthesis of information - enabling the student to become a real producer of documentary resources
- using an attractive design in the writing of a message	- font size and text spacing must be adequate to the peculiarities of players - using an attractive font and background - the adequacy of the content of the message and iconic register to the peculiarities of the players

Table 1. Pragmatic highlights in the management of electronic communication
(adaptation after R. Răduţ-Taciu, M.-D. Bocoş, O. Chiş, (coord.), 2015, pp. 416-417)

C. Cucoș (2006) presents the evaluation criteria of a digital curriculum product, namely: relevance of content and methodology; transparency with respect to clarity: of the goals, of the formulation of the results the student will obtain, of the presentation, of the methodological principles; validity; attractiveness; flexibility; openness; participation and socialization.

3. Analysis of math online games for primary education

For our study were analyzed for free online math games for the primary education. Only numeracy games, mathematical calculations with the four operations (addition, subtraction, multiplication and division) to integers and fractions games were studied. Games were to be searched only on Romanian language sites in order to analyze the variety existing on the local market and to what measure they correspond to the Romanian curriculum. A first observation is that there are no specific sites with mathematical games în Romanian, but sites with various games, unlike the English language for which there are many such sites. Some sites have subpages with mathematical games like: http://www.xjocuri.com/jocuri-cu-matematica.html; www.jocuri-friv.ro/jocuri-cu-matematica.html, and on others math games can be selected only by search like: www.ejocuri.ro, but there are also sites that math games appear inserted in the other categories, for example: http://jocuri.itbox.ro/jocuri-indemanare/. A special case is the publishers' sites that produce educational CDs (which can be purchased for a fee), and which post in addition other materials and educational math games online in order o promote their CDs. Among these sites are: eduteca.ro, edituraedu.ro, http://www.didactic.ro/jocuri (promoting Intuitext products). We have not found Romanian official sites (of the Ministry of National Education or other institutions) fostering / promoting mathematical post content online, not just games, but also educational animations or films, Power Point presentations, etc.

Didactic analysis of online games was made analysing the following aspects:

- *Easiness of access to the game and of using the game.*

Many games have advertisements inserted in their opening that support the free access to them. Some games need a long time of waiting to open due to the commercials, while others cannot even be opened. Often must be sought carefully on the screen the area that opens the game, because sometimes the games open in marginal areas of the screen and cannot be intensified the full screen. Sometimes when you want to open a game, another tab appears that does not always direct you to the desired game, but for other games.

- *Suggestivity in the naming the game.*

Most often, the name of a game suggests the theme, the interface or the game characters and less the mathematical content covered, e.g. "Rapunzel exam in mathematics" (http://www.jocuri-friv.ro/joc/13972/clopotica-scoala-de-zane.html); "To decorate the forest" (edituraedu.ro) is a solitaire-type game in charge with tasks like finding neighbors of the numbers 1-10. A suggestive name would have been: "Let us decorate the forest playing with neighbors numbers from 1 to 10". On some sites the name of the game presented at first (in Romanian) does not correspond with the game name's presentation after opening it (in English), e.g. the game "Ecuaţii joc de matematică" (in translation "Math Equations game") after opening appears as "The Equador" (http://www.xjocuri.com/jocuri-cu-matematica.html).

- *The themes and math games online interface* are varied, including elements from:

- school life (hall of the classroom, blackboard: green, black, white; chalk, calculator etc.) - e.g. http://www.mathgame5-10.com/ro/#audience, http://www.xjocuri.com/-by-matematica.html (the games "Exercises at the blackboard," "Calculation games", "Mathematical general culture", "Learning math with Julia games" etc.);
- everyday life - e.g. "At the grocery store" (eduteca.ro), nature - e.g. "Adventure on the lake" (edituraedu.ro);
- sports games - e.g. "Mathematics in Baseball" (http://www.xjocuri.com/jocuri-cu-matematica.html);
- known films and animations games - e.g. "Mathematics with Dora," "Help the descending numbers" (www.jocuri-friv.ro/jocuri-cu-matematica.html);
- known games adapted for mathematics (bingo, pairing, puzzle, Zuma etc.) - e.g. "Mathematical Lines" (http://www.xjocuri.com/jocuri-cu-matematica.html) or the same game with a different name "Zuma mathematics" (http://jocuri.itbox.ro/jocuri-indemanare/zuma-matematica/), "Let's decorate the forest" (edituraedu.ro) - solitaire-type game;
- abstract or imaginary themes - e.g. "The giraffe on diet" (http://www.didactic.ro/jocuri), "Conquer territories" (editura.edu).

Our finding here is that on Romanian sites is not found a wide variety of mathematical games compared to other foreign websites. For example, we have never found a game of bingo with mathematical calculations, but just one ordinary game of bingo in the English language, while on sites in the English language there are such games.

- *The characters* found in games are varied: cartoon characters loved by children, characters from films for children, ordinary people and / or children, monsters, animals, plants or various animated objects. There are also online math games without characters. Choosing a particular game, perseverance in the playful task proposed by it, child's desire to complete and even to repeat the game, including to recommend it to friends, all relates to the game's characters. While sorts of games that induce the idea of aggression, of violence, of failure or other negative connotations should not be agreed with, we have found that they are contained in online games, even if not so aggressive as in other types of games. We encounter therefore monsters, shootings, battles etc. Most often the result of genuine involvement of children in the game is an empathic ability derived by relating to his fictitious characters. It's enough to be a cheerful girl to empathize with Tinkerbell or a boy running through a difficult maze to find a treasure alongside Ben Ten.

- *Didactical communication management.*

Unlike traditional didactic games, in the case of online games communication is unidirectional from the computer to the user and must be consistent with the marks presented in Table 1. The information presented should be: the game description, purpose, target age group, explaining tasks (rules) of the game, presenting feedback (feedback, rewards, punishments). All games analyzed have a description in Romanian. There a brief description and information can be found on the game tasks and rewards, but rarely on the targeted age group. Description has mostly the purpose to spark the child's interest to play. For games on websites that promote educational CDs, the items listed above are mostly present: e.g. game "The ducks to bed" (http://www.didactic.ro/jocuri) has the following description - "This is a free online game where you can be a reliable aid for ducks who must call their ducklings back from play time. This is an educational game suitable for those who want to test their knowledge fast and fun"; explanation of the game - "Put in the right of every duck as many ducklings of the same color as indicated in the number above them. Only after you have completed correctly the columns, you can move to the next number "; targeted ager group – 3rd grade; assessment at the end of the game - "Unfortunately, time is up and there are still ducklings who have not returned from play time. Their mothers are worried and ask you to help them again." On the other hand, many of the games have descriptions in Romanian, but the game itself is in English. The description is written without diacritics, with spelling and writing errors. We can not establish if they were created in such manner or if they were downloaded from foreign sites and translated using translation toold, such as Google translate. Certainly some games an be found on multiple websites. Explanation of game tasks is not always clear, counting on the fact that users will figure things out on the way or through repetition of the game. Regarding the feedback given to players, the games end with a score display and / or verbal or written feedback. Sometimes assessments are not suitable; such as "The giraffe can eat sweets because of you" in the game "The giraffe on diet" (http://www.didactic.ro/jocuri) as it induces in children the desire to eat sweets, although the intention of the game (as shown by the title) is a good one. The reward offered most often is passing to a higher level.

- *The types of game elements* met are based on the most widely used following: choice from several possible ones, sometimes the choice being a multiple one, completion response - for example, the result of a calculation, moving parts, pairing, finding several numbers that have a particular property - e.g. finding three numbers from adjacent houses of which the last selected which is the result of a calculation of the first two.
- *The number of people involved în game.*

We have found only individual games that do not allow other competition than by improving the score obtained, or by switching to a higher level of play. We have identified only one game, "Duel of spring" (http://www.didactic.ro/jocuri), in which the player character duels with Mordeus.

- *Game time* is often limited. However, considering that the game can be repeated as many times as you want, time spent in the game is not monitored. The question of time spent online by children remains a problem unsolved at the level of specialists. This temporary sequence should be placed corectly under what we now call school time, in the teaching community of leisure pedagogy.
- *Mathematical contents and their accuracy.*

We have identified games addressing: numeration from 0-1000000, mathematical operations with natural numbers (addition, subtraction, multiplication and division), order of operations, finding the unknown number and fractions. In general, mathematical contents are correct, with small exceptions. For example, some games use signs like * for multiplication and / for division, signs that we do not routinely use in written mathematical calculations. Some games offer the same exercises replay, which makes that game to be played only one, maximum two times.

- *Consistency of the entertaining content with the school curriculum*.

We have found that only a few games, especially those on CDs specify the age or class at which the games can be used. Therefore, the consistency was checked only in those games. Due to the changes in the syllabus for primary education, many games could not be revised, so some games that are proposed for the 1st grade can now be used in the pre-school class too, such as the game "Ladybugs" (edituraedu.ro).

- *The skills* analyzed *that games form,* in addition to the cognitive ones, mind-different aspects of thinking such as: analytical mind, ability of synthesis, decision making, speed, sense of observation, attention, fine motor function. However, these skills are often only partially communicated to the users.
- *The existence of game use suggestions.*

We have not found such suggestions, except for that one game, which is presented in paragraph 4.

4. Examples of good practice of online math games

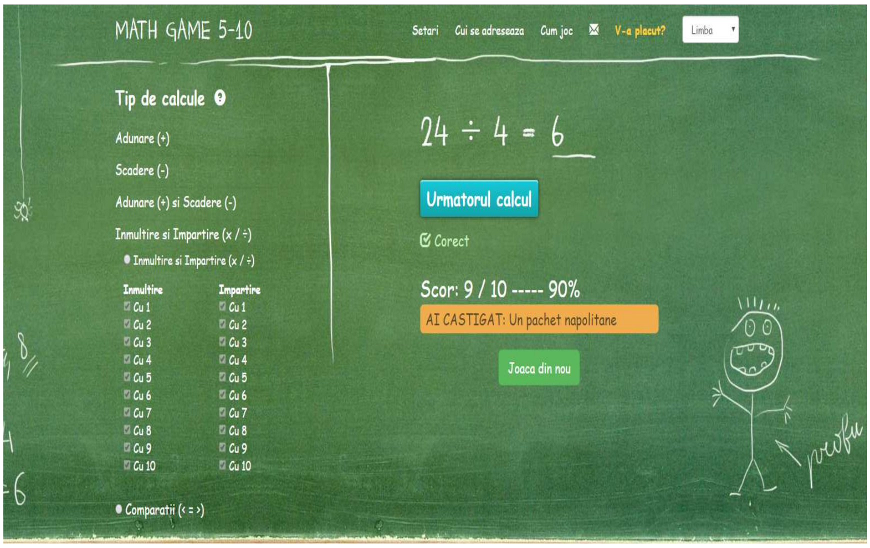

Figure 1. "Math game 5-10" interface

An example of good practice is Math Game 5-10 (http://www.mathgame5-10.com/ro/#audience). The website assumes promoting a game "very effective for any child who is learning elementary math." The target age group is stated as being "children between 5 to 10 years". The game interface is similar to that of the school board (Figure 1). This game has information addressed to parents on what kind of expectations the children can have after practising the game. In the section "How" of the game there are shown information for parents on setting the parameters: the number of tries for each session; thresholds for the prize I and II. Also, the parent / adult can choose what prizes to grant the child (the default is to award a package of wafers for the First Prize and a candy for the Second Prize). The mathematical content of the game are the four basic mathematical operations with natural numbers and comparing numbers up to 100. The game allows you to select an operation and customize it. The user must enter the result on keyboard (in the case of calculations) and select one of the options <,> or = to compare numbers. The feedback is instant, the score appears during the process and time is not limited. What we appreciate about this game is that it can be used both in the classroom and at home, both for practice and for assessing students' ability to conduct operations with natural numbers. Even in the case of the existence of a single computer in class, students can take turns playing, the teacher receiving an immediate feedback of the student performance after which he can think of differentiated approach strategies.

5. Conclusions

According to the document entitled *Key Data on Learning and Innovation through ICT at School in Europe* (EACEA P9 Eurydice, 2011) digital learning games belong to the types of software that almost all European countries promote, Romania not being a part of them. For this reason we have not found the existence of Romanian official sites (of the Ministry of National Education or other institutions) fostering / promoting mathematical post content online, not just games, but also educational videos, animations, Power Point presentations etc. Thus, Romanian teachers do not have online validated materials for training. Yet the need for such online material is felt both by teachers and students or parents. Starting from the fact that in the primary education, especially, didactic game is a beneficial training method, it outlines the need to introduce online math games in the training. Therefore, we considered that an analysis of existing online math games in the Romanian language is welcomed. The general result which was spun off from the analysis is that much of the online math games do not meet the pedagogical requests and even if the topics addressed spark children's interest, they only rarely develop certain skills. On the other hand, in most cases, we cannot even have such claims as sites do not say that the games they promote have an educational purpose. There are, however, some examples of good practice (one being shown above) that can be the starting point in developing really valuable online math games. In this category are includes games made for CDs that are well designed in terms of items you need to find in a teaching game. Also, they are much easier to access and play. Unfortunately, they are fewer games like this. We believe that practicing online math games must be in the teacher's attention as an alternative to traditional didactic games.

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Section

TECHNOLOGIES & VIRTUAL LABORATORY

Technologies (TECH):

- **Innovative Web-based Teaching and Learning Technologies, Virtual Laboratory**
- **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**

Using Entertainment Games in Education

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Abstract

The designers of Digital Educational Games (DEGs) face the major challenge of successfully blending and balancing fun, learning, and assessment, while creating motivating and engaging experiences for players in ethical, accessibility aware settings. Unlike Entertainment Games (EGs), DEGs have as primary focus knowledge acquisition, employing EG mechanics and adapting them to serve pedagogical purposes that reunite learning objectives, skills' development, and assessment metrics. Building upon the popularity of EGs, this research focuses on analysing how EGs could be customized for education and on discussing the potential of using pervasive EG mechanics to stimulate learning. The authors present a case study for the Pokemon GO game, synthetizing examples for key disciplines where the game could be applied as such or after customization.

Keywords: pervasive mechanics, entertainment, learning, Pokemon GO

1 Introduction

Digital games are interactive environments in which players engage in quests, strategize, plan, collect resources, and collaborate, in order to reach invidual or/ and common goals. Due to their potential to motivate and engage, efforts have been made to integrate them in schools as educational tools. Even if evidence exists on the successful uptake of game in education [1], Digital Educational Games (DEGs) have not reached the popularity of Entertainment Games (EGs) and further research is required, in order to bridge the gap between understanding DEGs and actually developing them. When designing DEGs, it is also important to consider several direct and collateral impact factors such as the interactions between the player and the game [2], definition of the game rules, the fact that technology can reduce social interaction [3], or the emerging transition from pre-defined scenarios towards user-personalized scenarios [4].

Since game design is a young academic discipline, analysing games and their structures lies at the root of defining best practices [5] and setting the foundation for the design of new games. DEG designers aim to stimulate learners to willingly and repeatedly play for extensive period of times [6]. To support the understanding of DEG design, this research has focused on analysing the educational potential of EGs. A case study for the Pokemon GO game has been carried out, and several examples of learning activities have been described for seven disciplines.

2 Case study: Pokemon GO

What made Pokemon GO so popular? How can finding and catching a Pokemon be so engaging? Why are players so motivated to walk? The following sub-sections describe the rules that apply in the Pikemon GO game and an analysing of how the game could be used for learning.

2.1 The rule of the game

Pokemons are the characters the players must capture during the game. There are 151 Pokemons available in the game, including the evolved forms. A Pokemon has the following characteristics:

name, combat points, type (normal, fighting, flying, poison, ground, rock, bug, ghost, steel, fire, water, grass, electric, psychic, ice, dragon, dark, fairy), weight, height, stardust, candy. There are four types of Pokemons that are region specific: Farfetch'd in Asia; Kanghaskan in Australia; Mr. Mime in Europa; and Tauros in America.

At the beginning of the game, the player is at level 1 with a total of 1,000 Experience Points (XP). To advance in the game, the player must accumulate a certain number of XPs. For example, to reach level 20 the player must have a total of 50 000 XPs, and to achieve the maximum level, level 40, the player must have a total of 5 million XPs. These points can be obtained by taking the following actions:

- **Capture a Pokemon**. Capturing a Pokemon is the main way to earn XPs. For each Pokemon, the player receives 1000 XPs. When capturing a Pokemon, the player can earn bonus points by using certain techniques to throw the PokeBalls.
    - *Nice throw – the player can obtain 10 XPs;*
    - *Great throw – the player can obtain 50 XPs;*
    - *Excellent throw – the player can obtain 100 XPs;*
    - *Curveball – the player can obtain 10 XPs;*
- **Hatch an Egg**. Eggs can be obtained by visiting PokeStops. They can be placed in an incubator and after the player will complete a certain number of kilometres, the eggs will hatch into a new or existing Pokemon. The XPs differ depending on the number of miles travelled:
    - *2 km - the player can obtain 200 XPs, but s/he will receive common Pokemons;*
    - *5 km - the player can obtain 500 XP, and s/he will receive less common Pokemons;*
    - *10 km - the player can obtain 1000 XP, and s/he will receive rare Pokemons;*
- **Evolve a Pokemon.** The player can earn 500 XPs when a Pokemon evolves;
- **New Pokemon to PokeDex.** Adding a new Pokemon to th Pokedex brings the player a total of 500 XPs;
- **PokeStop Check.** By visiting a PokeStop, the player can earn 50 or 100 XPs plus bonus items;
- **Defeat Pokemon in Training.** When a player fights in an arena of his/ her own team and defeats the Pokemon of an opposite team, s/he may receive 10 XPs.
- **Defeat Pokemon in Gym.** When a player fights in an arena of an opposite team, s/he may receive 10 0XPs.
- **Defeat all Pokemon in Gym.** When a player fights in an arena of an opposite team, s/he may use a number of maximum six Pokemons. If all the Pokémons present in the Gym are defeated, the player receives 50 XPs.
- **Using Lucky Egg.** The player can double the XPs, if s/he uses Lucky Eggs in a 30 minutes' interval.

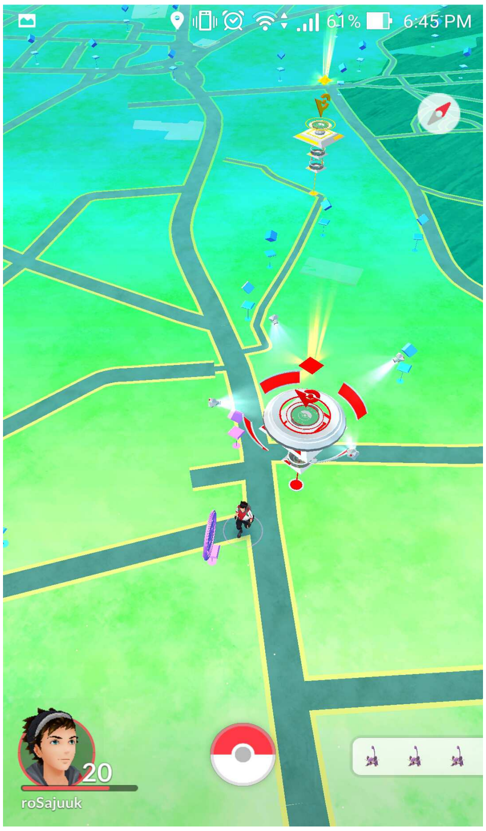

Figure 1. Catching a Pokemon

Figure 2. Egg hatching status

While advancing in the game, the player can earn different rewards (PokeBalls, Incense, Lure module, etc.), or can unlock new facilities: obtaining Great Balls (Level 12), or Ultra Balls (Level 20).

When a new Pokemon appears in a location, the player's phone will vibrate. To capture a Pokemon, the player uses PokeBalls. Each Pokemon is surrounded by two circles: a while circle that represents the area where the player has to throw the ball to capture the Pokemon; and a second circle that can be green, yellow, orange, or red, corresponding to the level of difficulty.

To capture a Pokemon, the player has to throw a ball at it. The ball will have a certain trajectory based on the throwing mode used. If the player misses, the ball is lost. It is recommended that the ball is thrown with an average speed. When the player holds the finger on the ball for a few seconds, the trajectory of the ball can be changed from straight to curve, increasing the chances of the player to catch the Pokemon, but the player will earn lesser points. The game provided little information on how to throw the balls, the player learning by trial and error.

When fighting, there are two types of actions: attacking and dogging. Attacking is carried out by multiple tapping on the player's Pokemon to launch a faster attack. The more tapping, the more chances the player has to increase the efficiency of the attack. The player can abandon a fight or can choose a different Pokemon. For training, the player can use a single Pokemon. To defend, the player will move his/ her Pokemon to the left or to the right. Using such actions represents a mean to preserve the Pokemon's energy and be more prepared for fighting.

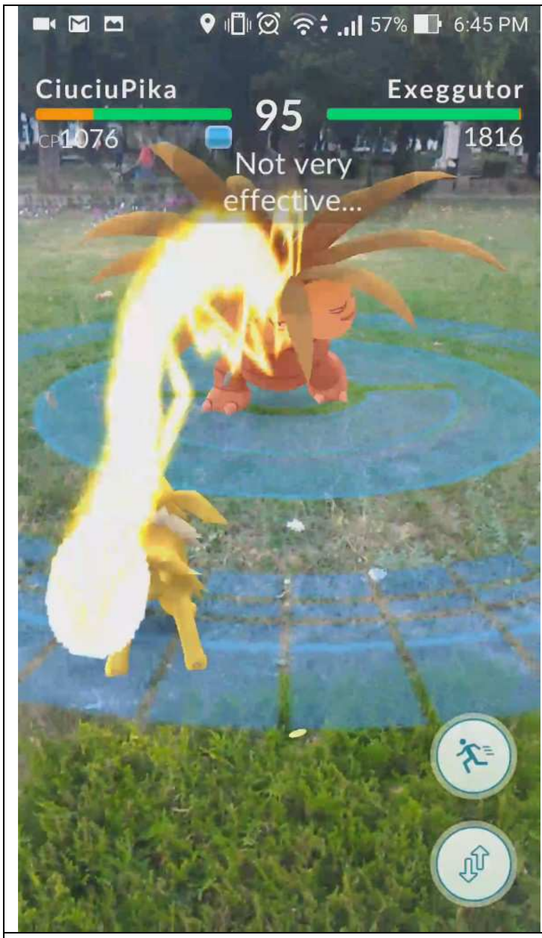

Figure 3. Initial attack (ineffective)

Figure 4. Effective attack after changing Pokemon

A Pokemon can become stronger by using Pokemon Candy. These game items can be obtained when capturing a Pokemon, by hacking an egg, or by transferring a Pokemon to Professor Willow. The Pokemon Candies are Pokemon specific. A Pokemon can evolve once or twice. There are Pokemons than cannot evolve or Pokemons that can evolve into a different type. For example, Eevee can evolve into Fire, Electric or Water.

2.2 Using Pokemon GO for learning

Research has shown the potential of using entertainment games for learning [7]. The approach proposed herein builds upon the popularity of such games and their capacity to motivate and engage, to reach specific pedagogical objectives. Considering the research carried out by [8] on pedagogically oriented game mechanics adapted for education from entertainment and casual games, the following game mechanics used in Pokemon GO have been identified as relevant for learning settings:

Table 1. Game mechanics

Game mechanics	**Pokemon GO mechanics**
• *Rewards* represent the feedback a player received for a successful action and they are used as incentives to sustain	Pokemon GO integrates a basic reward system that consists of points they player can obtain throughout the game, for example, by capturing

engagement.	pokemons or hatching eggs. Most layer actions in the game are associated with gaining a certain number of points.
• *Protégé Effect* represents the player's tendency to work harder for their teachable agents (i.e. their avatars or alter ego) than for themselves.	Players can evolve or power up pokemons. When a player fights in his/ her won arena, the Pokemon becomes stronger. The pokemons can be used in combat.
• *Resource Management* corresponds to establishing relative values for different types of resources in the context of the current state of the game.	Player consumes resources when evolving or powering up a Pokemon. E.g. candy, startdust, etc.
• *Collecting* enables the player to gather elements of virtual knowledge, competencies, or rewards that can be represented by virtual objects.	When playing, a player can obtain different types of resources: experience points, combat points, stardust, candy, etc. Resources can be obtained also when visiting PokeStops or the Shop.
• *Capture/Eliminate* represents the strength of the player that is defined by how many points or counters the player has captured.	When fighting in an arena of an opposite team, a player has the chance to capture all the pokemons available in the area, if s/he I successful.
• *Action Points* control what the player may do during their turn in the game by allocating them a budget of 'action points'.	Certain actions in the game, like evolving or powering up a Pokemon depend on the resources available. Also, when a stronger Pokemon is displayed, the player needs to have certain types of balls available in order to capture it.

All these are classical game mechanics that form the core of EGs and DEGs. The novelty in the case of Pokemon GO comes from building upon the pervasive approach, as well as upon the Pokemon series and upon Ingress, the Niantic Labs's previous success. Games, like Pokemon GO and Ingress, can be used as best practices for DEG design. We have included some exampled for educational domains were the game or the game mechanics could be used (Table 2):

Table 2. Game mechanics used on specific domain

Domain	**Examples of applicability**
General	Directions or shortcuts for finding Pokemons can be presented as knowledge puzzles that the player has to answer correctly. The player can increase a Pokemon's combat power through training in knowledge camps.
Health & Fitness	The game implicitly supports a healthy lifestyle, as its core mechanics relies on the distances covered by players.
Math	The location of a Pokemon could be expressed as a geometry exercise. In combat, the player could calculate the intensity of the attack, and success does not rely on the frequency of multiply tapping, but on the difficulty of the exercises the player has to solve.
Physics	The player could calculate the trajectories of the balls they are throwing to capture Pokemons.
Learning foreign languages	Players could choose to play the game in a different language. While exploring different locations, players could learn new words in a foreign language. Players could engage in game conversations in a foreign language.
History	The game characters could be associated with historical figures and past events. PokeStops are already available in places like historical landmarks,

	monuments, museum, etc.
Architecture	The game locations could be associated with historical places, enabling players to learn and experiment the historical values of various cities or of historical/ new buildings.

3 Discussion and conlusion

Even if EGs do not specifically target knowledge acquisition [9], players implicitly learn. Learning focuses around exploring the characteristics of the virtual worlds and discovering the best strategies to win the game. However, applying the same game mechanics in DEGs does not automatically generate massive uptake at players' level. Transposing EG mechanics into learning settings necessitates the overcome of ethical factors, for example managing historic violence, or culturally sensitive data [10].

It is, therefore, important to consider that not all famous EGs have become popular overnight and maintaining the popularity of a game is not an easy endeavour. Counter-Strike is a game developed by Valve that was initially released in 1999. Warcraft universe was first released in 1994. The World of Warcraft, developed by Blizzard Entertainment, is the fourth title in the series and held the Guinness World Record [11] for the multiplayer online role-playing game with the most subscribers. Counter-Strike: Global Offensive is the fourth game in the series and since its release in 2012 it has sold more than 25 million units.

The pervasive, multiplayer game Ingress, created by Niantic Labs and available for Android and iOS, was launched in December 2013 and by 2016 it has over 10.000.000 installs according to Google Play. The current version is 1.106.1 proving that the company has constantly invested in maintaining and enhancing the game features to fuel its popularity. Building upon the success of Ingress, Niantic Labs has launched Pokemon GO in July 2016. Within two months the game has more than 100.000.000 installs and it has reached version 0.35.0.

Both Ingress and Pokemon GO are augmented reality games and the reward mechanics are strongly bound to the activity the player performs in the real world. The more the player walks the more points and items s/he can collect in the game. Other activities in the games require the player to be go to a specific area in order to collect valuable artefacts (access keys, Pokemons, etc.). A significant gameplay difference between Ingress and Pokemon GO is that Ingress is structured to be more revealing about the items that can be found on the map, while Pokemon GO integrates a certain amount of uncertainty about the exact location of each item.

Game customization brings opportunities to adapt existing games to specific learning contexts and personalized learner needs. If DEG should include additional rewards to motivate players remains an open question.

Acknowledgement

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Educational Technology Using Virtual Laboratory for Teaching Programming

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Abstract

The paper is a continuation of the author's research in the virtual laboratories area. An analysis of the scientific literature in the area of programming education is provided. Contemporary educational technology in the virtual laboratory environment is discussed. A special attention was paid to the procedural and descriptive aspect of educational technology in programming. The algorithm of the educational process in programming, the set objectives, the program content, the methods and educational tools, which are used for achieving the intended results when using Virtual Laboratory, are described.

Keywords: Educational technology, Programming, Virtual Laboratory

1 Introduction

In the 21^{st}century significant changes in the educational technologies occur. The people, involved with the politics and activities in this area, are actively looking for ways to prepare their students for the future. The impact of the new information technologies aims at developing skills, and innovative methods and approaches, for establishing a sustainable educational environment. The educational technology is always consistent with the objectives of the study process. The technology is specific in its use of the new forms of teaching the students in the programming field using virtual laboratories.

The aim of this article is to trace the number of elements of the educational technology for training in programming with the use of virtual laboratory, its content and elements as well as the roles of the participants in the process of training.

2 Materials and methods

The results of this report are based on existing theory in the field of Educational Technology (EdTech) and the methodology of the programming training, presented in literary sources and publications, as well as the existing technological and educational environment and practical experience at the Faculty of Technics and Technologies (FTT). The view of the authors for the educational technology applicable to teaching C++ programming using a Virtual Laboratory for Teaching Programming (VLTP) is based on these theories and practices. The use of the virtual laboratories for educational purposes is not a new format but it is not completely researched yet in the field of programming. The virtual laboratories allow for the simulation, monitoring, testing, analysis and control of processes and phenomena. Through the application of the virtual laboratories in teaching programming one can achieve an increase of the motivation and cognitive activity of the students, and develop their abilities to solve problems. The computer simulations, interactivity, perceptibility and dynamic environment help develop the algorithmic thinking of the students, a "*procedural and conceptual understanding of the algorithms*" (Grozdev, 2011) is achived. It reduces the abstractness in perceiving the concepts, "rising the emotional impact as it satisfies the natural curiosity of students and critical understanding of the information" (Grozdev, 2011).

In order to analyze the educational technology using a VLTP, we will define the term "virtual laboratory", and this is the working definition used in the process of our scientific research. The virtual laboratory is a computer based laboratory, which interactively provides the possibility to conduct experiments and perform various measurements, either by using a software simulation of real objects, devices and processes, or by using a remote access to the real laboratory (Nedeva, Shivacheva2015). The VLTP interactively, by using a software simulation of basic concepts, algorithms and data structures, creates the possibility for easier perception and understanding of the matter by the students and for the development of the students' algorithmic thinking, which is needed for the practical application of the acquired knowledge. The aim is to reduce the level of abstraction in understanding the algorithms, to analyze the process of implementation of the computer programs, to stimulate the heuristic ideas, to understanding the theory and to gather experience. The dynamics in the workplace and the interactivity allow direct impact on the parameters of the generated source code and monitor the changes in its operation (Shivacheva, Nedeva, 2016).

For the practical realization of the use of the VLTP it is necessary to select and apply the appropriate educational technology. There are a number of definitions for educational technology in both theory and practice. Therefore, there are summaries and systematization of the concept of educational technology, which in the pedagogical theory is also called pedagogical technology and is an integral part of the educational technologies. For the purposes of our study we look at some basic definitions of educational technologies. Educational technology - it is a systematic method for creating, applying and determining the whole process of teaching and learning, taking into account the technical and human resources and their interaction, which concentrates on the optimization of the forms of education (UNESCO). "*The definition of pedagogical technology as a set of systems and operating procedures for functioning of all personal, instrumental and methodological tools used to achieve the educational goals*" (M.V.Klarin in Selevko, 1998). The author of this definition examines it in several aspects:

- Scientific-educational technology - part of the pedagogical science that studies and develops the objectives, content and methods of teaching and which designs the pedagogical processes;
- Process-descriptive technology: description (algorithm) of the process, a set of objectives, contents, methods and means to achieve the expected educational results;
- Process-efficient technology: the implementation of technological (teaching) process, the functioning of all personal, instrumental and methodological pedagogical tools.

We analyze the **process-descriptive technology,** which is the closest to the target that we have set ourselves in this report, by presenting**:** the algorithm of the educational process; a system of educational objectives; a program for the educational content; methods and tools for achieving the results.

The definition, used by Guzeev is similar – educational technology can be called a complex, consisting of (Guzeev, 1996):

1 a presentation of the planned learning outcomes;
2 diagnostic tools to assess the current knowledge of the students;
3 a set of educational models;
4 criteria for selecting the optimal model for specific conditions.

Richey defined educational technology as the study and ethical regarded of facilitating learning and improving performance by creating, using and managing appropriate technological processes screen, and resources". The Association for Educational Communications and Technology denoted instructional technology as the theory and regarded of design, development, utilization, management, and evaluation of processes screen, and resources for learning"(Bruckner, 2015).

Educational Technology is the efficient organization of any learning system adapting or adopting that, processes screen, and products to-serve basis identified educational goals. This involves systematic identification of the goals of education, recognition of the diversity of learners' needs, the contexts in which learning for take place, and the range of provisions needed for each of these (Rajakumar P., Kumar Shiv, 2006).

The universally accepted definition of EdTech involves processes, methods and techniques, products, resources and technologies organized into workable systems. The recognition of the need for a multilevel organisation of a classroom, for instance, along with the designing of an appropriate programme and its implementation, become as much an exercise in EdTech as the use of audio-visual aids or the information superhighway. EdTech could be defined in simple terms as the efficient organisation of any learning system, adapting or adopting methods, processes, and products to serve identified educational goals. This would involve: Systematic identification of the goals of education, taking into account nationwide needs (higher scalability, for instance), the system capabilities, and the learners' needs and potential (RajakumarP., Kumar Shiv, 2006).

3 Discussion and Results

A mixed form of education is in use at FTT – Yambol, which is a combination of traditional education, e-learning and a virtual laboratory. The virtual environment MOODLE, which is customized for the needs of Trakia University - e-TrUni (http://edu.uni-sz.bg), is used for the e-learning aspect. e-TrUni contains a C++ programming course, which offers the students: a syllabus, an educational and assessment technology, a vocabulary, videos, lectures, presentations, practical exercises designed with methodological guidance for use. In this e-learning environment the students can write in forums or chat. e-TrUni eases the communication among the students and also provides the opportunity for a video conference by using the integrated module Big Blue Button. The educational technology should take these objectives into account and has to meet a number of general and basic criteria. Zhilkin called it "30/70" (Zhilkin, 2007):

1. Educational technology "30/70" has to be effective, that is, it should make it possible to use the existing university resources (academic staff, knowledge, information, technologies, finances).

2. Educational technology "30/70" should be attractive to the major subjects of the educational activity:

- for the students: the educational technology should be arranged in such a way as to provide the student with the sources, methods and tools for independent work, as well as to provide information about the design of the main areas of activity, in order for the student to actively to shape his/her education and further professional activity;
- for the lecturer: the "30/70" educational technology should be arranged in such a way as to free time for him/her to take part in research projects and in the innovation of the educational system.

During the educational process the student is the center of attention - enough time is allocated for the practical training and different active forms of education are used - programming tasks for independent work, course assignments, and tests for self-assessment. The implementation of the VLTP aims at stimulate the students' independent work, which has to be more difficult to solve. The students should be able to solve their independent work by using with the support and advice of the tutor and with the application of modern media for asynchronous and synchronous communication between the lecturer and other students in the group. To achieve these objectives, we have to adapt the existing educational technologies, but we stick closer to the "30/70" educational technology EdTech idea, which implies that 30% of the students' workload should be devoted to auditorium work and 70% should be allocated for independent work for each of the educational modules.Fig.1.

Looking at the components of the EdTech we start with the presentation of planned educational outcomes. They include knowledge and skills that students should gain during their education. The knowledge and skills that they need to acquire during their education in the field of programming are defined in the curriculum of the studied subjects, and these same subjects are the base through which the basics of C++ programming, and algorithms and data structures are mastered.

The development of the educational technology for use of VLTP requires the separation of the C++ programming training modules and those covering algorithms and data structures. Each module is a logically complete fragment of the educational material, are presents the functional unity of the educational content and the type of organization of the learning process. The educational content for learning C++ programming using VLTP at FTT - Yambol covers the following modules consisting of a number of different interactive teaching units: Module "Basic concepts"; Module "Operators"; Module 'Arrays'; module "Dynamic Structures"; Module " Basic Algorithms" Module "Functions and recursion"; Module "Search algorithms"; Module "Sorting algorithms".

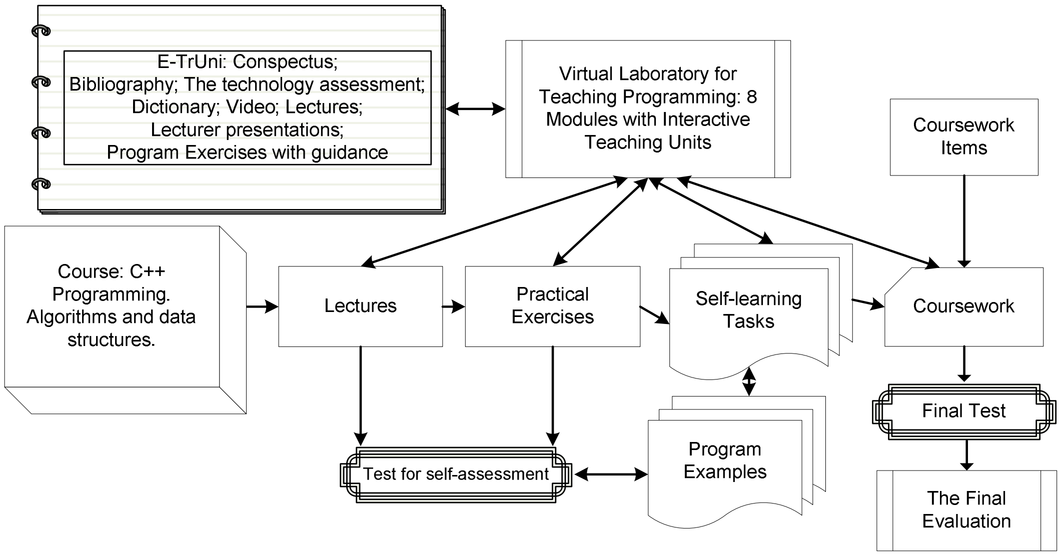

Fig. 1. Blended Learning Resources of FTT – Yambol

In the EdTech, which uses a VLTP- based education, a maximum volume of practical tasks is provided. For the successful completion of these tasks various forms of training are used, such as practical exercises, multimedia materials stored in the e-learning system, examples and tasks in the VLTP. The sequence of conducting classes, the place and role of the lecturer the and tutor are shown in Fig.2. In the EdTech using VLTP the lecturer has the following tasks: he/she is responsible for developing the educational modules; for organizing and structuring their content; for developing and selecting of the format for organizing and conducting of the education. The lecturer defines the relationship between the modules and together with an expert of training methodic developsthe methods implementing the educational process in such a way as for the designed form to reach the students. The lecturer also plays the role of a technologist in the development of the various forms of education laid down in the e-TrUni and in the VLTP. At the same time, he/she is able to design, then to analyzes and take part in research projects.

The tutors in the programming EdTech work mainly with the students, and do not take part in the preparation of educational content (curriculum). The tutor can perform his/her tasks independently, if the education is entirely a distance learning program. If the education is of the mixed type, in which together with the traditional forms of education, e-learning platforms and VLTP are also used, the lecturer can also perform the tasks and duties of the tutor. But to distinguish the duties of tutor we will clarify his/her role in the EdTech using VLTP:

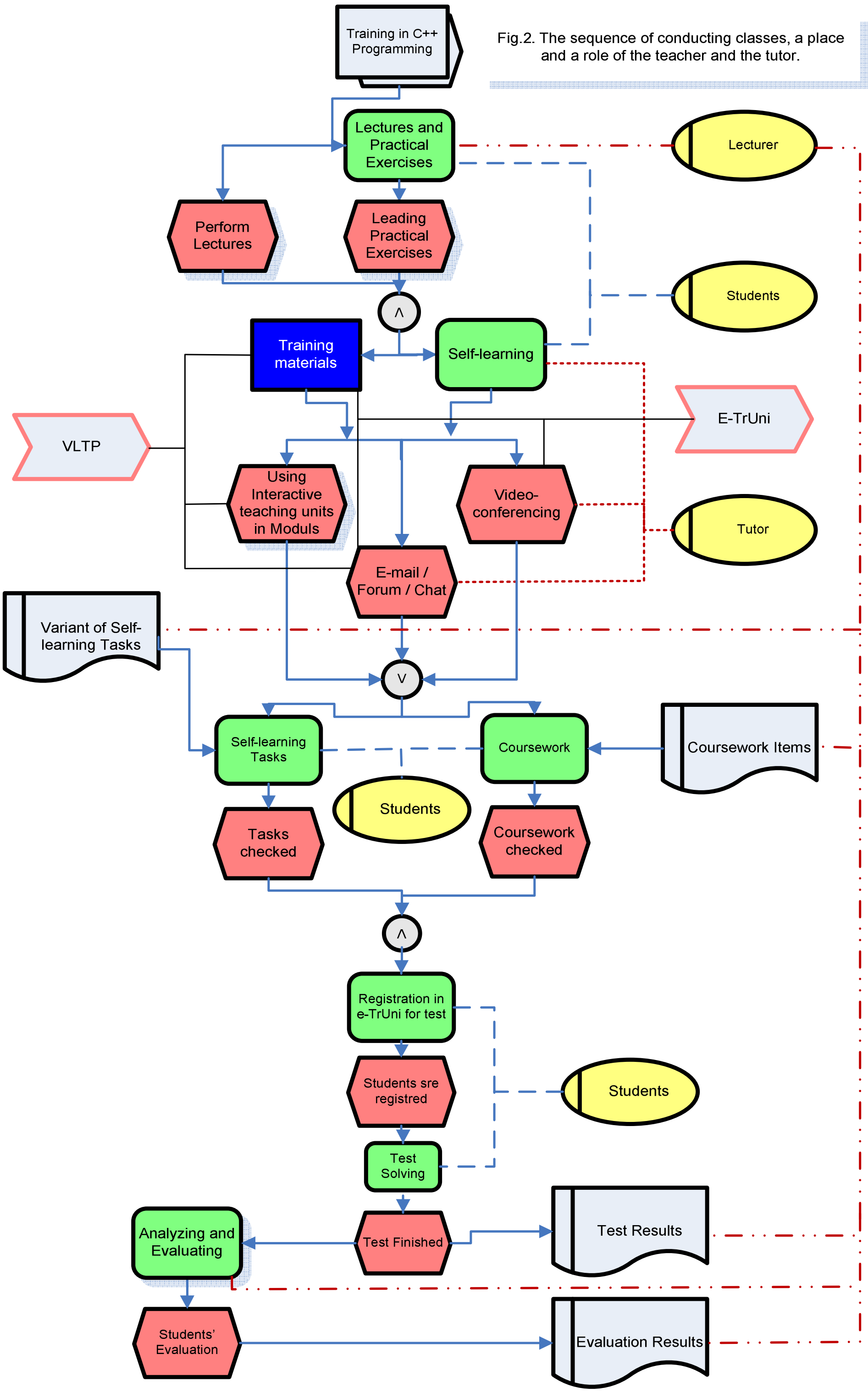

Fig.2. The sequence of conducting classes, a place and a role of the teacher and the tutor.

- he/she works only with the students.
- he/she knows the technology and organization of the curriculum, which is thematically divided to different modules.
- he/she is responsible for supporting students while they are using the e-learning platforms and the VLTP.

When we have an educational system that uses a VLTP we can supplement the following new tasks for the lecturers:

- They have to determine the content of the modules and the interactive teaching units of the VLTP;
- Selects the suitable examples and tasks for the modules, which are dependent on the content of the interactive educational units;
- Prepares the tests for each of the VLTP modules;
- First-hand tests all of the tasks and test included in the VLTP modules;
- Develops the technology for designing and constructing the VLTP, if this is necessary;
- Develops VLTP or participates as a consultant in its development.

The level of student's knowledge is determined in two stages: the first one is a mid-term assessment using tests that are part of the e-learning system. The students can also self- test their knowledge during the semester using the e-TrUni or the VLTP. The second stage is a final test at the end of the course, which is held parallel with writing a course work (term-paper) that the students present at the end of the semester. All tests are conducted on a computer. For this purpose, there is a pool contain in different questions, divided by topics. For the test, using a random selection process, a number of questions from the questions' pool covering the relevant topics is chosen. The number of questions is discussed in advance by lecturers and the tutor, which are part of the educational process.

4 Conclusion

Using theEdTech for teaching programming the following is achieved: the objectives for the necessary knowledge and skills in C++ programming in C ++, and algorithms and data structures, are provided in the curriculum; a model for using the already existing at FTT - Yambol resources for mixed learning is presented; based on this an EdTech algorithm for mobilizing the information technology and human resources is developed; the specific functions of the lecturers and the tutor,in order to fully support the students during the educational process are determined.

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Concerning the Potential of Using Game-Based Virtual Environment in Children Therapy

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Abstract

The aim of this paper was to examine how video games can be designed so that through the Kinect sensor they would help in the process of physical therapy of disabled children that takes place in the comfort of their own home. The need for such games is rather great as the process of rehabilitation and even learning can be challenging and tedious. The games provide a safe and controlled environment in which the children can thrive.

Keywords: Kinect sensor, Game therapy, Virtual Reality

1. Introduction

The most efficient way to help special needs children is to find alternative methods of teaching and helping them develop the competences they lack or need. Interactive movement through games was proven to lead to a positive physical therapy experience. It can also increase motivation for learning new skills and even boost self-esteem.

1.1 State of the art

The Kinect sensor was released in 2010 as a peripheral for the Xbox 360 and was marketed as a way to add motion controls to games [1]. Microsoft even added it as a peripheral when Xbox One was released, boosting features in it such as voice control for the console. While some see it is as nothing more than a video-game add-on, the Microsoft Kinect commands technologies that extend practical usage beyond the gaming realm.

After Microsoft released the SDK for Kinect, it has been a vital part in many medical, robotic and other fields, re-invented as part of a homemade hack, a university research project and lots more [1].

Here are some of the innovative ways the Microsoft Kinect is being used.

Using the Kinect sensor one can produce high-Quality 3D Scans.The Kinect Fusion project [1] allows a user to use an off-the-shelf Kinect camera as a 3D scanner for producing high-quality 3D scans of small or large objects.

Another useful project would be Ubi Interactive, project that turns any surface into an interactive touch-screen [1]. An even more fun way of using the sensor would be to create a virtual dressing room in which one can see how clothes would fit them without having to try them on.

It is also used in the medical field to help with stroke recovery. The sensor has even been used by surgeons in the middle of surgery in order to obtain certain information about the patient without needing to interact with non-sterile surfaces. The Kinect sensor was even used in the development of a system that can translate sign language into spoken and written language in near real time

A project using Microsoft Kinect, even more impressive than the ones mentioned above is VirtualRehab.

VirtualRehab [2] is a clinically validated physical rehabilitation system which uses videogame technology and allows the monitoring of the progress of patients from anywhere in the world. It can be used in clinics and hospitals as well as in the patient's homes allowing them to continue their rehabilitation treatment which leads to improved patient outcomes.

VirtualRehab allows the treatment of different functions for the following pathologies: Neurodegenerative diseases, (Multiple sclerosis, Parkinson's Disease, Amyotrophic lateral sclerosis (ALS), Alzheimer's Disease), Neuromuscular disorders (Dystrophies, Myopathies, Amyotrophies and Neuropathies), Neurovascular disorders / Trauma (Stroke and Traumatic brain injuries), and Mobility for the elderly.

It is the very first virtual rehabilitation software to be classified as a medical device, registered as a Class I, getting the CE Mark conforming with the regulatory system of EU´s Medical Device Directives.

2. Application architecture

In the following chapter the application will be presented as well as the necessary hardware components for it to work.

The main objective of the research was to create an interface between a user and a 2D game, interface that would contribute to the improvement of behavioral control and motor and sensorial skills of the patient, without the need of additional equipment. It was also intended to be a learning tool for children with autism. By using their gestures to navigate a virtual menu the user's coordination will improve.

The game is based on the ability of the patient to recognize and classify objects into categories.

Grouping objects [3] is an important skill, particularly for lower functioning children who have autism. The ability to group objects can be linked to activities that include turn taking and waiting. Grouping objects also assists students with autism to develop a greater understanding of characteristics or attributes. The ability to group and categorize objects is often a prerequisite skill for work preparation activities at school and vocational training for post school options. Many students with autism may develop obsessions associated with sequencing or grouping highly desired objects. Students with autism often need to generalize a skill in a range of setting before the skill can be mastered.

All this was achieved by using the Microsoft Kinect Sensor.

All being considered a complex interaction system that integrates gesture commands, using the same hardware resources, was developed. Thus, the Kinect device was used to recognize the user's gestures.

2.1 Technologies

The game employs the Microsoft Kinect V2 sensor [4] to capture theuser's movements. It has been programmed with Unity [5], a "game development ecosystem" which is able to create 3D and 2D content and run it in multiplatform systems like Desktop, Web, iOS [6], Android [7] and consoles.

The recommended hardware and software configurations are:

- A Microsoft Kinect sensor V2, which includes a power hub, USB cabling and an adaptor
- A PC with Microsoft Windows V8 or later with the Kinect drivers installed and the next recommended:
  - ✓ 64-bit (x64) processor
  - ✓ 4 GB Memory (at least)

- ✓ Physical dual-core 3.1 GHz (2 logical cores per physical) or faster processor
- ✓ USB 3.0 controller dedicated to the Kinect V2 sensor
- ✓ DX11 capable graphics adapter[8]

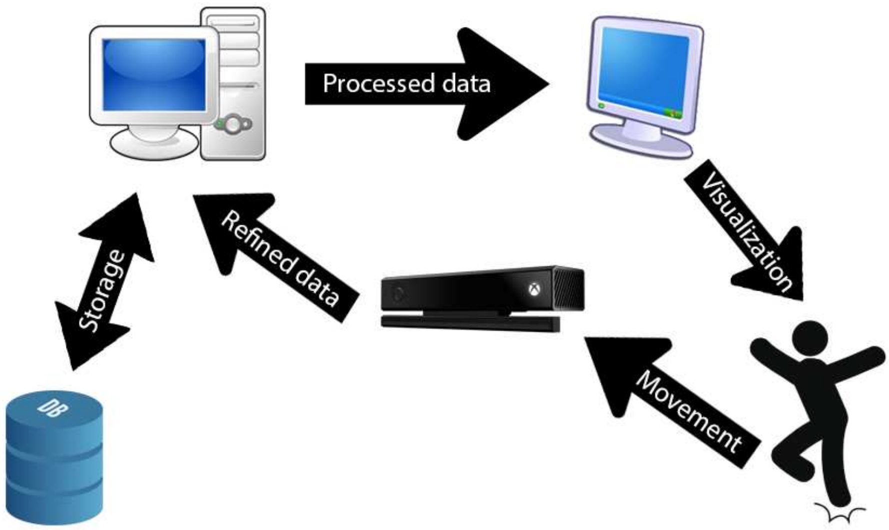


Figure 1. Conceptual design scheme (adapted from [11]).

The PC projects the game on a monitor/screen making the visualization easier for the patient.

The Kinect sensor is placed in front of the user, above or under the screen. As the user moves the sensor registers the movements and sends the refined data to the PC, resulting in movement in the game.

After the patient completes a level/task, his/her progress will be stored in a database so that the physician can review it and adjust the game in order to see further progress.

2.2 Software components

Virtual reality [9] is the creation of a virtual environment presented to our senses in such a way that we experience it as if we were really there. It uses a host of technologies to achieve this goal and is a technically complex feat that has to account for our perception and cognition. It has both entertainment and serious uses, including a wide variety of applications in architecture, sport, medicine, arts, and entertainment.

The concepts behind virtual reality are based upon theories about a long held human desire to escape the boundaries of the 'real world' by embracing cyberspace. Once there we can interact with this virtual environment in a more naturalistic manner which will generate new forms of human-machine interaction (HMI) [10].

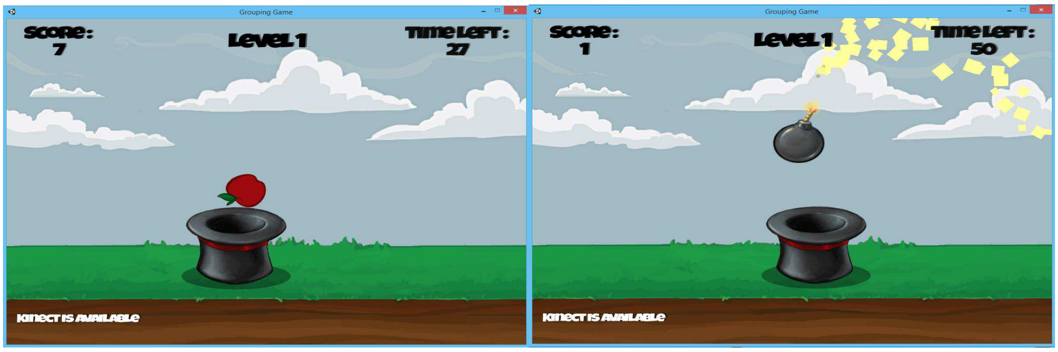
The technology is becoming cheaper and more widespread. We can expect to see many more innovative uses for the technology in the future and perhaps a fundamental way in which we communicate and work thanks to the possibilities of virtual reality.

3. Use case

The application is essentially a game that helps children with special needs.It in composes the following competences:

- Attention;
- The ability to coordinate movements;
- The ability to react quickly;
- The ability to recognize and group objects that fall in the same category.

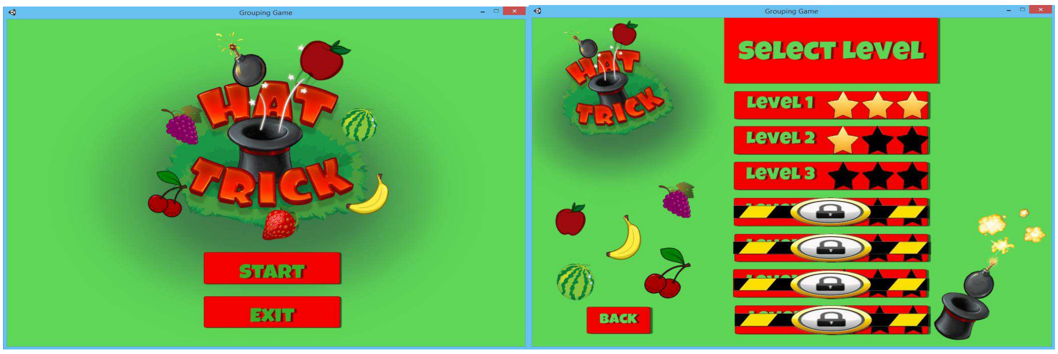
The game is based on the ability of the user to differentiate fruit from booms and catch them in a hat (Figure 2).The user will be able to navigate through the game using hand gestures. To hat will move left to right on the screen as the user leans left to right in real life.



a) b)

Figure 2.a) Object interaction, b) Object interaction.

After finishing a level a new one will be unlocked (Figure 3). To help the experience and to motivate the user a star based reward system was implemented.



a) b)

Figure 3.a) Object interaction, b) Level menu.

The main advantages of these types of games are:

- They are affordable to everyone as you can do these types of exercises from home
- They do not require additional equipment that can restrict movement or get in the way
- And maybe the main advantage would be that they are customizable and easy to use

The only drawback of the application at this moment is the precision of the sensor which has not been yet programmed to identify only one user at a time.

4. Conclusion

In conclusion virtual reality can be useful in the personalization and optimization of therapeutic procedures, helping lots of children gain confidence in their own ability and teaching them new skills.

In the future with the help of specialized personnel these kind of therapy can be implemented, tested and improved in order to help as many children as possible.

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Investigating the possibilities of document cameras for quality assessment of foodstuffs by measuring of color

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Abstract

The possibilities for use of interactive presentation devices as powerful tools for increasing students interest, activity, motivation and participation are analyzed. Established is the possibility of measuring color with document camera in direction of determining the color characteristics of food products. The effectiveness of this type of measurement is confirmed by the study results.

Keywords: Interactive Presentation System, Interactive Whiteboard, Document camera, Color measurement

1 Introduction

Overhead projector and Diaprojectors in past years have been the main tool for visualization of learning in university audiences. Followed by multimedia projectors that with rapid pace are widely used as a tool and in modern stage whiteboards in audiences are replaced with interactive presentation systems (IPS). The interactive whiteboard (IWB) becomes significant, and in some cases mandatory element of the interactive classroom of the future. Its contents if necessary, can be seen and shared by the personal devices (tablets, laptops) of all students, and in addition can be integrated with other modern technical tools for training (Dineva&Nedeva, 2013; Shivacheva at al, 2015).

The document-camera enables the presentation in real time on items on the IWB with high quality and speed. The device can also be used to create pictures or video of real objects and text, some models are fully integrated with the software and hardware of IWB. The document camera can be used for visualization of static and dynamic objects for demonstration of experiments, increase image and presentation objects under the microscope on IWB (Pehlivanova&Ducheva, 2011; Nedeva&Dineva, 2013; Stoykova, 2014).

In recent years there has been increasing interest in using the document camera for recognition of geometric objects that are drawn on the document (triangle, circle, line), text recognition and mathematical formulas, and for objectively determining the quality characteristics of objects as food, making it a means of training courses related to technical non-destructive methods for assessing the quality of these products (Zlatev at al, 2013).

Interest in the practice represents the accuracy and realism of the images obtained with a document camera. This also applies to the identification of components of food products (such as pork, eggs, bread) which substantially have a complex structure, color, and change the surface characteristics upon storage. These characteristics of foodstuffs put out the assess of the quality of the food products with technical tools (Kirilova at al, 2010; Mladenov at al, 2014).

The aim of this report is to establish the possibility of measuring color with document camera with direction of determining the color characteristics of food products.

2 Exposure

The color of foodstuffs is difficult to assess because in different parts of the product at the same surface structure is not same. By digital image analysis of the surface color characteristics of foodstuffs is possible to be segmented images as individual specific areas and the entire surface of the studied object (Vasilev, 2016). The information gathered will establish objective criteria for assessing the quality of the food products. This type of information is not achievable with other devices.

By the colorimeter can be measured the color characteristics of object (Smits, 2010). This gives precise resultsbut they are receive point by point. Hence this type of measurement is time consuming and difficult to measure spatial data. Furthermore, the colorimeters have a significantly higher price compared with digital cameras. These advantages of cameras such as ability for contactless measuring of the color simultaneously in several areas on the object surface, aroused interest among researchers, because such devices can be used for quickly get information about the color of objects.

3 Results and discussion

To realize the objective of the study is built experimental arrangement presented in Figure 1. The experimental system consists an interactive presentation system include personal computer, interactive whiteboard, software to interact with the whiteboard. Used are two specialized document cameras Epson ELPDC11, Epson ELPDC06 and Web camera.

A comparative analysis is made of the possibility of measured values of color with these document cameras.

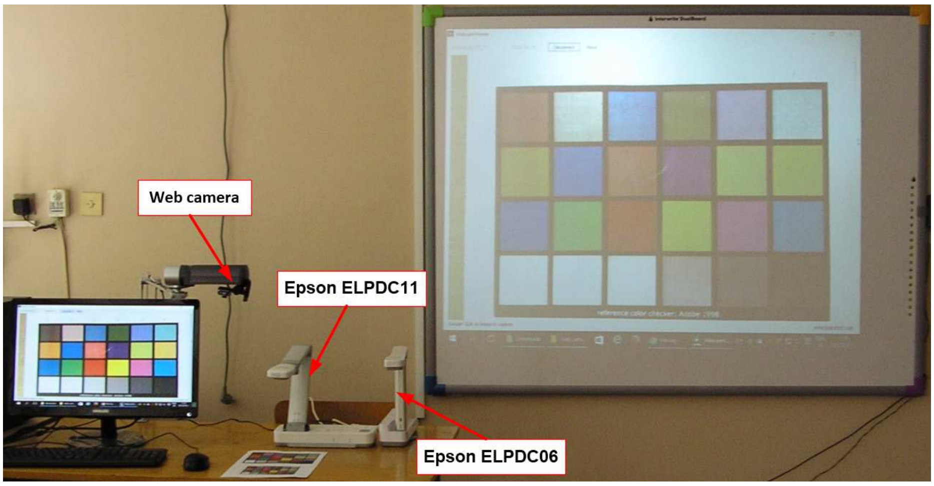


Figure 1. Experimental system – general view

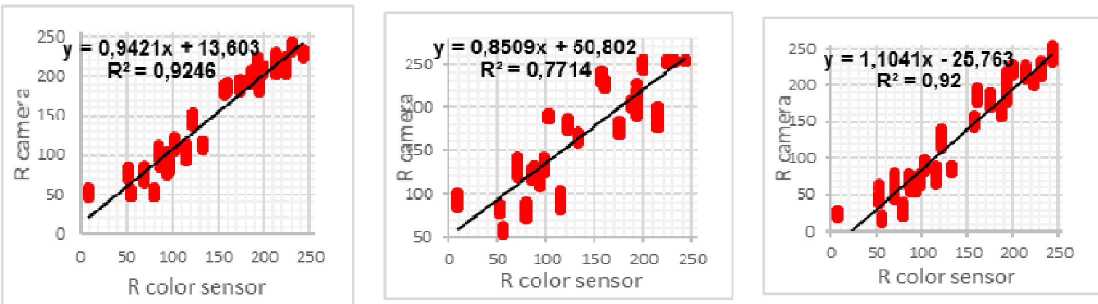
As reference values were used those measured with a colorimeter using a calibrated digital sensor for measuring the color in the RGB color model (Figure 2b). Used is reference with 24 colors (Figure 2a).

a) 24-color reference b) color sensor TCS34725

Figure 2. Color checker and color sensor

Color sensor is constructed as a module of the sensor for colors TCS34725 (Adafruit, 2016), which has an integrated IR filter and sensor elements for RGB color and white light. It has a digital I^2C interface and features very high sensitivity and dynamic range 3800000: 1, allowing the use of the module behind the dark glass.

As a criterion for assessing the accuracy of the measurement with document camera compared with data obtained from the colorimeter were used correlation coefficient and relative error.



a) Epson ELPDC11 b) Epson ELPDC06 c) Web camera

Figure 3. Reference and measured values of $R_{(RGB)}$ color components

The correlation analysis is made in the following sequence:

➢ Checked are the homogeneity and linearity of the data which revealed that the data are homogeneous and linear;

➢ Determined are the correlation coefficient for the color components of the presented color models.

Figure 3 shows correlation coefficients for the R component of the RGB color model. Epson ELPDC11 and Web camera show homogeneity of the data, while Epson ELPDC06 they are not well grouped around the the linear model by which they are presented.

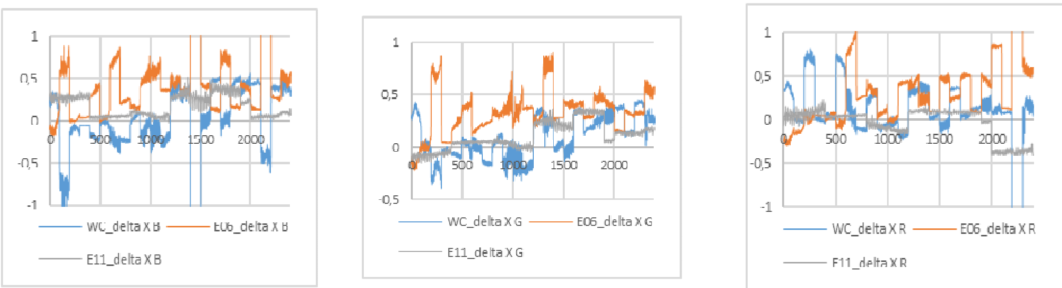
Table 1. Correlation between the values of the color components, as measured with a colorimeter and camera

Camera model	**Color component**											
	R	***G***	***B***	***H***	***S***	***V***	***Y***	***I***	***Q***	***Y***	***cb***	***cr***
Epson ELPDC11	**0,962**	**0,958**	**0,971**	**0,952**	0,920	0,938	**0,961**	**0,967**	**0,957**	**0,961**	**0,986**	0,939
Epson ELPDC06	0,878	**0,954**	0,935	0,801	0,920	0,881	0,935	0,944	0,944	0,935	**0,974**	0,924
Web camera	**0,959**	0,900	0,773	0,825	0,800	0,852	0,929	0,896	0,947	0,929	0,928	0,890

In Table 1 are inflicted the correlation coefficients for the tested color models – RGB, HSV, YIQ, Ycbcr, for the three document cameras and correlation coefficients with values above 0,95 are marked.

$$\varepsilon, \% = \frac{X_{colorimeter} - X_{camera}}{X_{colorimeter}} . 100\% \quad [1]$$

The comparative analysis is made based on the relative error in measuring of color with the three document cameras with mathematical relationship [1].
Figure 4 shows graphics of the relative error ΔX, determined for the three cameras.



R G B

Figure 4. Relative measurement error for cameras using RGB color model
WC_delta X – ΔX for Web camera; E6_delta X - ΔX for Epson ELPDC06; E11_delta X - ΔX for Epson ELPDC11

Table 2. Minimum and maximum values of the relative measurement error

Camera model	Color component					
	min ΔX_R	*max* ΔX_R	*min* ΔX_B	*max* ΔX_B	*min* ΔX_G	*max* ΔX_G
Epson ELPDC11	5%	7%	2%	6%	3%	5%
Epson ELPDC06	30%	63%	18%	28%	22%	41%
Web camera	40%	73%	19%	52%	16%	48%

Table 2 shows the minimum and maximum relative error in measuring color depending on the used document camera.
From the results presented it is seen that the highest indicators - high correlation with measurements with a colorimeter over 0,95 and low relative error of 2-7% have a document camera Epson ELPDC11, and with the lowest indicators is a Web camera.
The results obtained confirm reported in the literature (Zlatev at al, 2013; Stoykova, 2014)] significant number of shortcomings in the implementation of Web Cameras as document cameras for the purpose of visualization and measurement. Document cameras are designed to give a clear image to have realistic images while Web cameras are used primarily for video contacts locally or over the Internet and their manufacturers does not provide functionality for visualization and measurement.

4 Conclusion

The results of the analysis of the available literature show that in modern stage interactive systems for presentation incorporating interactive whiteboard, personal computer, special software and accessories, increase the level of visualization teaching content and increase the interest of students to the studied disciplines.

By conducted comparative analysis is found that by document cameras can be receive complete information about the measurement object at the pixel level, rather than in separate parts of the object as in the standard colorimeters.

The effectiveness of document cameras in color measurement is confirmed by the research results. The resulting correlation between the color measured with document cameras and that obtained with the reference color sensor is above 0,9.

Acknowledgements

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Integration of additional device to a multimedia presentation system

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Abstract

The aim of this report is to present the technical characteristics of multimedia presentation systems in terms of their advantages and disadvantages. To review the possibilities for using hardware with open source to build additional devices to interactive presentation systems by using such devices to offer a solution to one of their disadvantages associated with data received from them.

Keywords: Multimedia, Interactive presentation, Open source hardware, Spectrofotometer

1 Introduction

One of the modern learning technologies with wide, even wider implementation are multimedia technologies. Basic tool into them are multimedia presentations.

The meaning and purpose: to illustrate the educational content; content can be viewed quickly and efficiently by students; to maintain attention; Content can easily be meaningful; To support its retention; provoke the activity of the learner (Quertinmont at al, 1997; Rousseau at al, 2006).

With the help of multimedia relatively difficult to understand theoretical formulations may be presented in an attractive and simple way to cause more interest and to facilitate the adoption of school curriculum disciplines.

During the lectures, seminars, classes at school, at university or public lectures aiming to convince the audience in a thesis or teach certain knowledge in a particular area (Nedeva at al, 2012). Exactly, in those places it is important to be well tolerated and effective knowledge and used in new and useful ways of teaching. The positive aspects are primarily concerned with the wider visualization capabilities in the form of pictures, maps, tables, videos. And the possibility of an interesting way to present information in a concise and succinct form. On the other hand making presentations or materials for a multimedia presentation must be familiar with the basic rules of successful multimedia presentation of a matter – less, but more important text clearly and highlight differences in terms of font, color (Nedeva&Dineva, 2013).

The multimedia allows for a more attractive presentation of the material, causing and more interest and feedback from the learner. Multimedia is entertaining and educational at the same time.

The multimedia practically is realized by technical means. These hardware devices are used for:

- Recognition the actions of teaching and learners with visual, audio and tactile sensors with the purpose of influencing the multimedia system;
- Displaying visual, audio, tactile information;
- Implementation of communication functions in order to remotely access the multimedia.

Table 1 presents the technical methods of interactive interaction between the trainer, presentation systems and the trainees. This type of interaction is known as multimodal (Shivacheva, 2015).

Table 1. Technical methods for interaction

Regime	Type	Technical device
Visual	Visualizing images	Display
	Generating text	
	Pattern Recognition	Video sensor
	Text recognition	Electronic marker
Audio	Artificially generated voice	Loudspeaker
	Voice recognition	Microphone
Tactile	Touch recognition	Touch sensor
	Recognition of vibrations	Accelerometer
	Generation of vibrations	Vibrating mechanism
Communication	Network connections	Communication environment – local or Internet

Recognition of visual, tactile and audio information is performed in the following steps:

- Preprocessing – formation of sensory data, and extracting the specific features;
- Training of the recognition system – creation of predictive models;
- Recognition – pattern, voice, touch recognition.

The multimedia is used in interactive presentation systems. They fully or partially implemented technical methods of interactive interaction between the trainer, presentation systems and the trainees.

2 Interactive presentation systems

The interactive presentation system (IPS) includes in its composition, projector, interactive whiteboard (IWB), additional devices (figure 1). Thereto be able to integrate additional devices such as document cameras, Clickers, tablets that have proven advantage in the learning process. Their use in the learning process increases the level of visualization and displaying of content and increase the interest of students to disciplines (Stoykova, 2015).

The presentation systems are generally used for the creation and delivery of static images that have the following problem – they can not easily be changed during the presentation. This disadvantage hinders their use in the implementation of practical exercises related to the determination of parameters eg of foodstuffs by technical means.

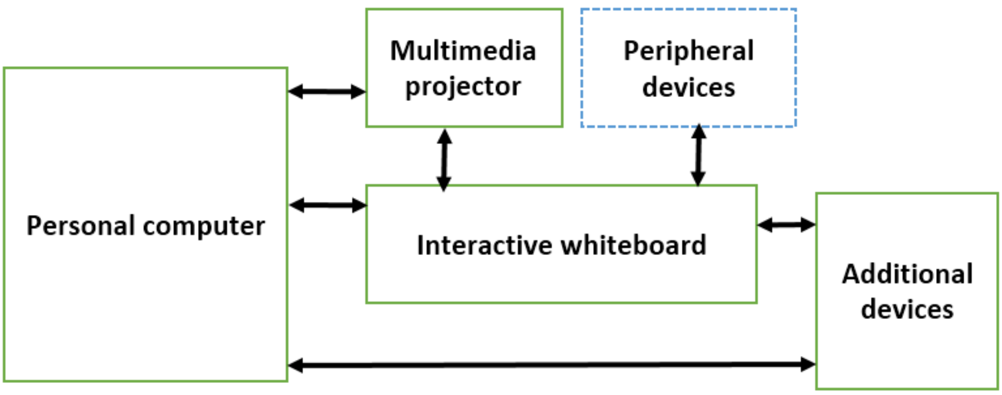

Figure 1. Block diagram of typical interactive presentation system

Available are studies related to the solution of this problem. In (PASCO, 2016) is presented commercial optical drive - wireless spectrophotometer that through software that can visualize the spectral characteristics of passage, absorption intensity on the screen of a tablet, mobile phone or through a projector on an interactive whiteboard. The disadvantage of the discussed device is that it is intended primarily for teaching chemistry and the software, although is distributed free has limited set of features and can not be modified to the needs of different users.

3 Using open source hardware in the design of addition devices to IPS

In recent years there has been interest in building systems of type „open hardware“ in the academic and scientific fields. Devices built on this principle have the advantage that their schemes and programs are easily accessible and can be modified and adapted to the requirements of individual users. The reasons for this, for example, are best features of products that are not inferior to commercial analogues lower cost of technical equipment, lack of licensing fees, a large volume of freely available device-specific information and other technical solutions for its realization, sharing the experience with other developers.

The development of open source software aimed to reduce the cost of software to levels that are acceptable to most people, increased interest in hardware with open source is due to the fact that it aims to reduce the cost of equipment for research and such devices to be available to everyone (Open source hardware, 2015).

The interest in the development of devices using the camera of mobile phones as an optical sensor to build colorimeters, spectrophotometers, object recognition in images is increased (Cogliati at al, 2014). The reason for that, as the authors of the studies point is that the majority of the population, about 80% live in developing countries where laboratory equipment such as spectrophotometers is not widespread as the purchase and maintenance of such devices is unbearable for them.

On the other hand mobile phones and web-cameras connected to a PC are widespread and the modern models have some possibilities for use as sensors for receiving, processing and analysis of optical information (Scheeline, 2016).

4 Spectrophotometer developed as additional device of IPS

Based on the literature review and known methodologies (Pearce, 2014; Mladenov at al, 2015) to build hardware and software products have been developed and studied spectrophotometer operating in the visible spectral region that can be used both as an additional device to an interactive presentation system and for realization of practical exercises on subjects included in the curricula of departments “Electrical Engineering, Electronics and Automation” and “Food technologies” of faculty „Engineering and technology“ – Yambol, Bulgaria.

Light source from eight white LEDs operated in the range 450nm which illuminates the sample surface. These LEDs are connected through resistors with 200Ω resistance to the power supply DC 5V 2A.

Reflected light from the sample passes through the rectangular opening and is decomposed into the primary colors on a diffraction grating inclined at 10^o.

Video camera captures the area of decomposed of basic colors light and via a USB connection is introduced into the PC for processing.

To set the spectrophotometer used benchmark for calibration on white and black Lovibond with serial number 12064, made in 2006. The reference listed reflection spectra in the range 390-710nm with increment 10nm, and the values of white color in Lab color model.

The program of the system for obtaining spectral characteristics consists of two components – the basic program, operated by the user and a subroutine to convert an RGB image in spectral response in the visible spectral region.

The primary program works on the following principle: consistently capture five images of the area with broken into primary colors of light diffraction grating spectrophotometer; Set aside R, G

and B channels in the image and subroutine conversion in spectrum; Received five spectral characteristics are averaged and output the final characteristic that is saved to a file.
In the subroutine for conversion of RGB to spectrum in the visible region are used techniques presented in (Glassner, 1989).
Used is a function of matching colors CIE 1964, with observer 10^o; D65 illumination values representing average daylight with UV components, 6500K.
Third stage is a transformation of the color components in the reflectance spectra.
The transformation of the values of XYZ color model in spectra reflection in the VIS, the area within 380 ÷ 780nm is done in mathematical relationships.
The interactive presentation system shown in Figure 2 includes interactive whiteboard "Interwrite Dualboard" with software „e-Instruction WorkSpace" (eBeam, 2016); PC with installed software of interactive board software system Matlab and MS Excel; additional device spectrophotometer presented above.
Remote access to interactive presentation system is implemented with software eBeam Connect, which is a web-based software, enabling teachers and students to interact in the learning process with Web-enabled devices such as iPad, tablets, laptops and smartphones. eBeam Connect enables the collaboration of browser-browser and browser-interactive whiteboard as the teacher can monitor the work of students in solving specific task in real time on IPS or on computer including in home, inflicting notes, comments, adjustments on the decision.

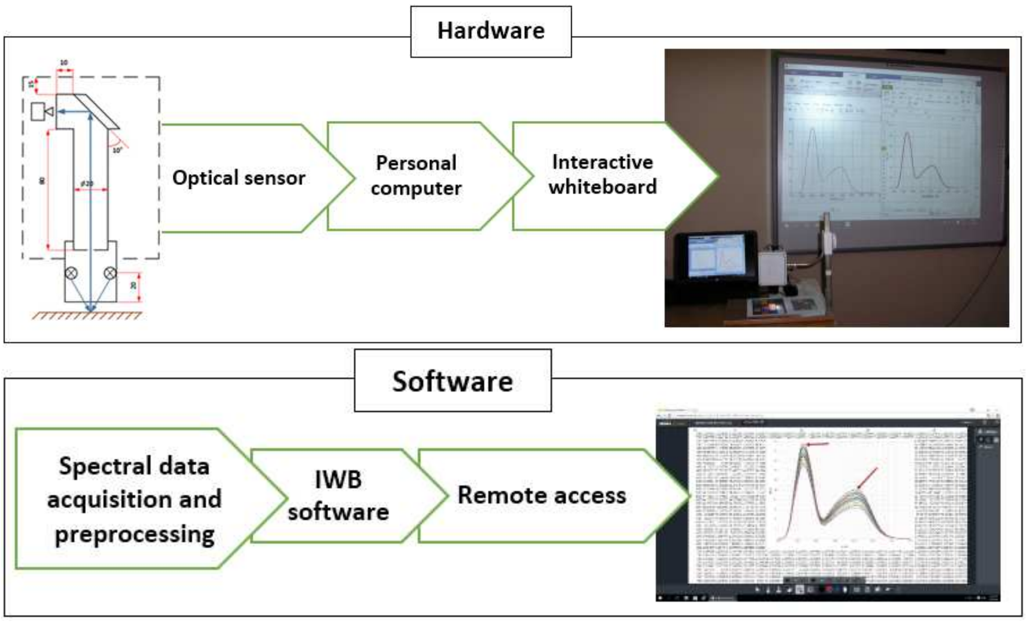

Figure 2. Hardware and software elements of the IPS

Using this software measurement results can be shared on devices of students - phones, tablets. students included in the current session, initiated by the lecturer.
The students and lecturer can inflict comments and notes on the presentation image, or to conduct operational control in real time (Pehlivanova&Ducheva, 2011).
The lecturer is able to use the electronic pen interactive whiteboard to work on the image and control the students.

5 Conclusion

The multimedia in training is a tool with high efficiency as development and its use is responsible and creative process, consistent with the objective psychological-pedagogical and aesthetic requirements.

The interactive presentation systems are an effective tool for disctance education respectively. e-learning, as the possibility to create and record in appropriate materials, which may then be saved in the virtual library of the university and used by students to theoretical and practical self at a convenient time and place convenient for them.

One disadvantage of the presentation systems that create static images and data generated can not be directly processed by the students, making it difficult to use them for training in working with technical equipment and the analysis of food products.

There are additional devices that partially solve this problem as they are designed mainly for training on specific subjects and the software, despite being distributed for free have limited set of features and can not be modified to the needs of different users.

The proposed spectrophotometer allows adaptation to the needs of individual users because its software was implemented in Matlab environment is represented as an algorithm and to it may be added additional features. For building the hardware part used a small number of affordable units with low cost.

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Wearable solution for assessing physiological arousal towards students' interest and engagement in the classroom

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Abstract

The subject of this paper are the possibilities of application of wearable computing, Internet of Things and mobile technologies for stress management in education environment. A number of everyday situations if unpleasant may cause stress. Students are frequently under the stress that comes from lifestyle changes, tight deadlines, separation from home, changes in the social environment, or arousal when taking exams. Likewise, stress may occur from lack of understanding classes throughout semester. Currently, students are rating overall quality of the course at the end of the semester via anonymous surveys before they get their grades. Professors usually don't have feedback as of whether students have understood every lesson. In this paper we propose wearable solution for assessing physiological arousal towards students' interest and engagement in the classroom. In addition, we will propose mobile application that will enable the evaluation of each teaching unit. The research focus will be on implementation of system which consist of mobile application and wearable system for assessing physiological arousal in students.

Keywords: wearable computing, mobile phones, e-education, evaluation, stress

1 Introduction

The availability of modern information and communication technologies has significantly affected the learning process and information exchange.

Most of today's students belong to the so-called Millennial generation, the generation that was born and grew up with computers, Internet and mobile devices which are an integral part of their life. The development of the Internet and mobile devices has enabled access to an unlimited amount of data and efficient information exchange among students, Internet users and also have a huge role in the education system, cognitive processes and activities during the studies (Rodić-Trmčić, 2015).

Among other things, mobile technology in education may be applied for purpose of evaluation of teaching units which students attend during the semester. The evaluation of the overall teaching and assessment of teachers during the semester are now being carried out at the end of the semester by filling in an anonymous questionnaire. In this way, teachers do not always have full insight into how students understand each chapter and if they are interested to expand their knowledge. Sometimes students are not sufficiently encouraged to seek additional clarification of certain chapters or sections for additional examples of material that they do not understand.

Lack of understanding or material difficulties in keeping up can result in stress. In addition, the stress can be caused by changes in habits, separation from home, changing the social environment or because of excitement at taking exams (Sohail, 2013). Many students face different stressful situations during the exam, which can have a negative effect on the result of the exam or test. At the same time, poor results do not imply lower intelligence or knowledge of the student (Ali Mohsin & 2013; Rodic Trmčić, 2016). Identification of stress is possible using different sensors that measure vital parameters on the body indicating the occurrence of excitement in a particular context.

Today's smart phones are equipped with various sensors that can be used for educational purposes. Also, the sensors placed in the classroom or on the body of a student can help in raising the quality of teaching.

This paper presents a wearable solution for assessing physiological arousal towards students' interest and engagement in the classroom. In addition, Android mobile application for the evaluation of teaching is presented.

The aim is to present a model for the identification of mood among students induced by insufficient understanding of individual teaching units. Also, the aim of this paper is to encourage students to participate in teaching and to equally provide an opportunity to assess the quality of the exhibited lessons, provide suggestions and thereby improve the quality of teaching.

2 Literature review

Nowadays, communication between students is carried out by mobile phones. A huge number of university students have mobile phone as indicated by numerous studies: findings from survey conducted at the University of Australia (Koehler, et al., 2012) in 2012 states in favor of the fact; all respondents own a mobile phone, and 77.0% of them own a smartphone; (Tutkun, et al., 2014) that 98.5% of students from Turkey have a cell phone, and even 18.9% have more than one phone; internet research (Smith, et al., 2011) shows that 96% undergraduates have a mobile phone and 87.9% of dental students from Australia owns smartphones (Rung, et al., 2014; Rodić-Trmčić, 2015). Among students from Florida, 91.0% of them owns mobile phone (Chen & Denoyelles, 2013) and 97% medical students in Iran (Baghianimoghadam, et al., 2013; Rodić-Trmčić, 2015).

In Serbia, 83.4% of students of medical college own smartphones, while cellular and other phones have 16.6% of students (Rodić-Trmčić, 2015).

Many studies include mobile phones in the educational process in order to motivate and encourage participation in learning and as a tool for sharing educational content (Sung, Chang, & Liu, 2016). The mobile phone is, among students, usually used for accessing social networks in order to exchange information with colleagues or professors, photographing or recording notes during lectures or consultations, or for exchanging teaching materials. That is an opportunity for lecturers to develop new methods and educational activities, such as e-learning mobile phone applications for college students (Rodic-Trmčić, 2015). Mobile phones with built-in sensors (such as accelerometer, magnetometer, gyroscope, location sensor, ambient temperature sensor, light sensor, barometer, humidity sensor and proximity sensor, etc.), can become a natural laboratory for physics and can assist students in understanding the subject (González et al, 2014).

Many previous studies have dealt with the identification of stressors in the educational environment by using various sensors and often a combination of different sensors (Rodic Trmcic, Labus, & Radenkovic, 2016). Certain vital parameters can assist in the identification of stress. Such parameters are the heart rate, the conductivity of the skin, blood pressure, brain activity, and the like. In a study (Picard & Scheirer, 2001) sensor for conductivity of the skin is applied to identify the excitement of the participants at the symposium where the LED signal lamp simulates changes in values to match the excitement of listeners. Research conducted by Shen, Wang & Shen (Shen, Wang, & Shen, 2009) using psychological signals to predict the emotions, investigate the presence of different emotions during the process of learning and to propose for a sensitive model of e-learning. Data were collected via three sensors: skin conductance measuring electrodermal activity, photopletismograph that measures blood pressure and sensor electroencephalograph EEG, which measures brain activity. In one study (Kusserow, Amft, & Tröster, 2013), the heart rate sensor is implemented together with the skin conductivity sensor, accelerometer and temperature sensor in the familiar natural context - a public appearance of PhD students during the audience, where the observed variations in the value of the measured vital parameters were used to suggest the speaker how to change presentation or breathing. Measurements of human behavior and environmental factors that influence the behavior and condition of the body can be of valuable assistance in identifying stressors. Various parameters of the environment, such as ambient temperature, noise, CO_2 levels, may affect the concentration (Uzelac, Gligoric, & Krco, 2015) and academic performance (Dragon, et al., 2008) students. In addition to the aforementioned, external influences can be connected with the students’ emotions and physical movements during the monitoring of teaching and learning (Dragon, et al., 2008). Wearable devices for measuring physical activity, such as the Fitbit is used as a tool for checking the activities for online curses at physical education (Education News, 2014; Borthwick, Anderson, Finsness, & Foulger, 2015). In addition to these sensors, very common wearable device are glasses - Google glass, especially in medical education. In the field of cardiovascular medicine wearable technology has the potential to enhance medical education or patient safety (Vallurupalli, Paydak, Agarwal, Agrawal, &-Assad Köttner, 2013).

Also, there are wearables to monitor the safety of children in preschools and elementary schools, as well as their well-being. Often implemented as vest, which enables the monitoring of movements of children falling and the temperature in the environment in which the child resides (Jutila, Rivas, Karhula, & Pantsar-Syvaniemi, 2014).

Application of wearable computing is presented for learning purposes, as an integral part of e-education system, e.g. in order to support ubiquitous learning, interaction and collaborative work (Labus, Milutinović, Stepanić, Stevanovic, & Milinovic, 2015) or including students into different educational activities and disciplines (Espinosa, Lee, Keogh, Grigg, & James, 2015).

Use of wearable computing in students with physical disabilities (Borthwick, Anderson, Finsness, & Foulger, 2015) is significant. Students with vision or attention issues can participate in class using bone conduction, together with smart glass device could help students with hearing loss (Labus, Milutinović, Stepanić, Stevanovic, & Milinovic, 2015). Wearable product Keyglove provides support to persons with disabilities by combining the respective motion allows the use of the keyboard (Jutila, Rivas, Karhula, & Pantsar-Syvaniemi, 2014; Rowberg, 2016).

3 Model of wearable solution for accessing physiological arousal towards students' interest and engagement in the classroom

Model of wearable solution for accessing physiological arousal towards students' interest and engagement in the classroom is shown on Figure 1. The presented model consists of a wearable system, cloud infrastructure and mobile system for the evaluation of teaching. The optional part of the model is the health system. The model is based on communication between students/teachers and possibly medical staff that assess changes in mental and physical condition of students during the teaching.

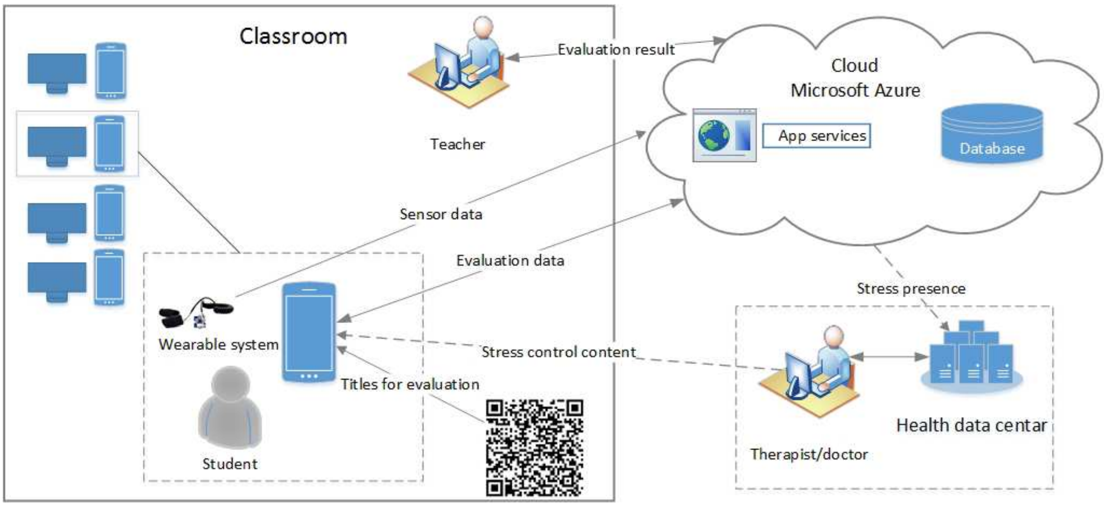

Figure 2. Model of wearable solution for assessing physiological arousal towards students' interest and engagement in the classroom

Cloud platform is the link between students and professors as well as students and health systems. Collecting data on the evaluation of teaching is done via student's mobile phone, and the data is stored and processed in the Cloud. Content that is evaluated via mobile application is on the Cloud, and is contained and displayed through QR codes.

Wearable device can be implemented in various accessories (gloves, bracelet or other wearable device), and should allow monitoring the psychological and physical condition of the beneficiary (student) using a variety of sensors (e.g. heart rate, skin conductivity, breathing sensor etc.).

The data collected by the sensor from the student's body are passed to the health care host, and changes in mood or stress levels are processed, analyzed and assessed. Assessment of the level of stress can be carried out through various algorithms or by a therapist who can deliver the type of content to control stress.

Improving the quality of teaching can be realized through a mobile system for the evaluation of teaching units during lectures. Figure 2 shows the process of improving the quality of teaching based on data collected on the evaluation of teaching. The teacher is able to create and apply different methods of exposure or to further clarify those parts of teaching units that have not been sufficiently understood.

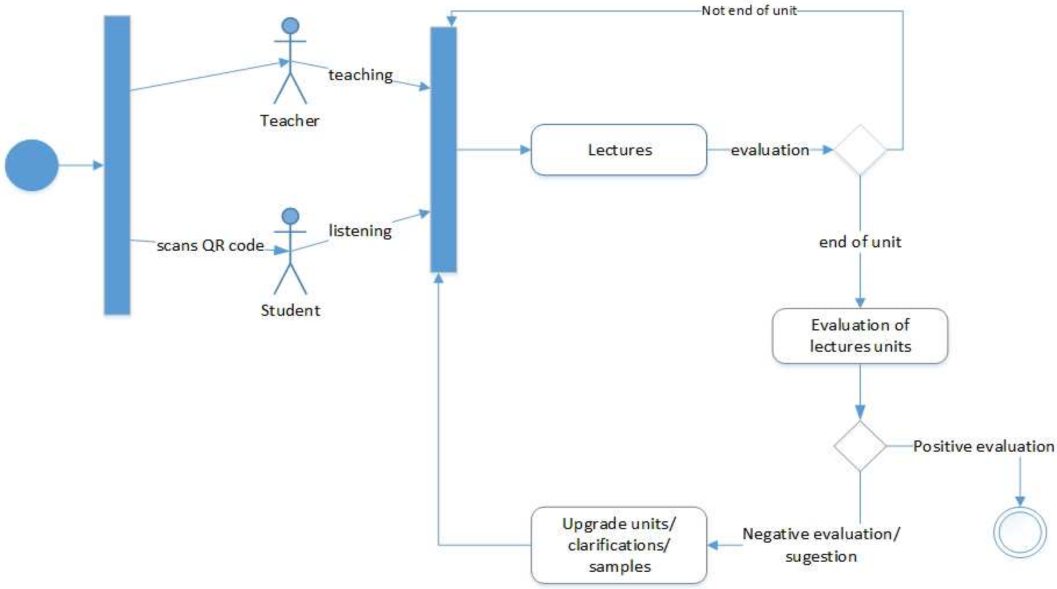

Figure 3. Process of teaching quality improvement through teaching units evaluation

4 Implementation of a prototype system for evaluation of teaching and wearable system for measuring stress

Wearable system is based on Internet of Things technologies, and system for heart rate measurement was used as a test implementation. The prototype is implemented using sensors, microprocessors and Arduino and RaspberryPi. The physical connection of the sensor is displayed using Fritzing software in Figure 3.

Implementation of these devices is done using the Python programming language and Php script language.

A sensors and microprocessors connected with variety of cables are shown, which connects the ground, a 5V voltage and data transmission cable. Connectivity between the Raspberry Pi and Arduino is achieved by using a USB cable (Rodic Trmcic, Labus, & Bogdanovic, 2016). A microcomputer sends the measured data to MSSQL database located on the Microsoft Azure Cloud platform.

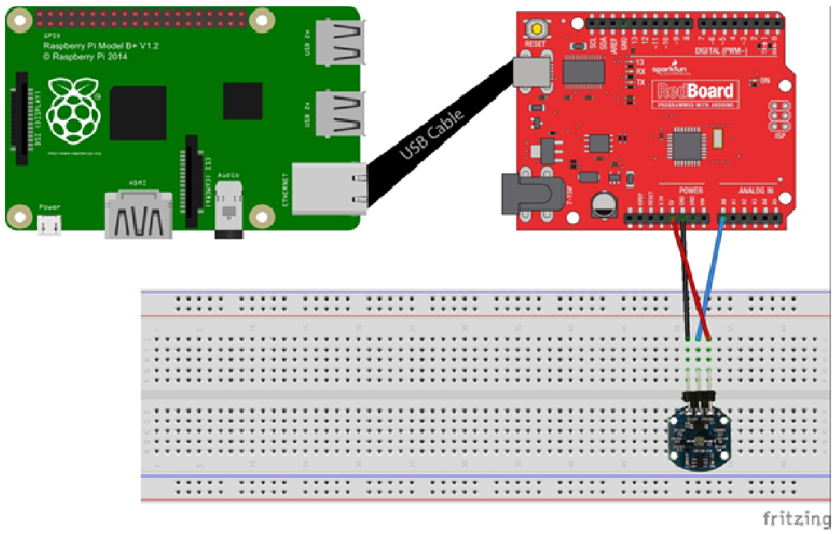

Figure 4. Physical connection of sensors, Arduino and Raspberry Pi microcomputer (Rodic Trmcic, Labus, & Bogdanovic, 2016)

Android application for the evaluation of teaching is being developed using Android Studio 2.1.3 platform and Java programming language. Screens of this application are shown in Figure 4. Mobile applications for teaching enable scanning QR code that contains information about the course units or titles of lectures to be evaluated. After scanning, the application displays a list of teaching units (chapters) that can be evaluated after listening. The result of the evaluation is forwarded through web services to the Cloud.

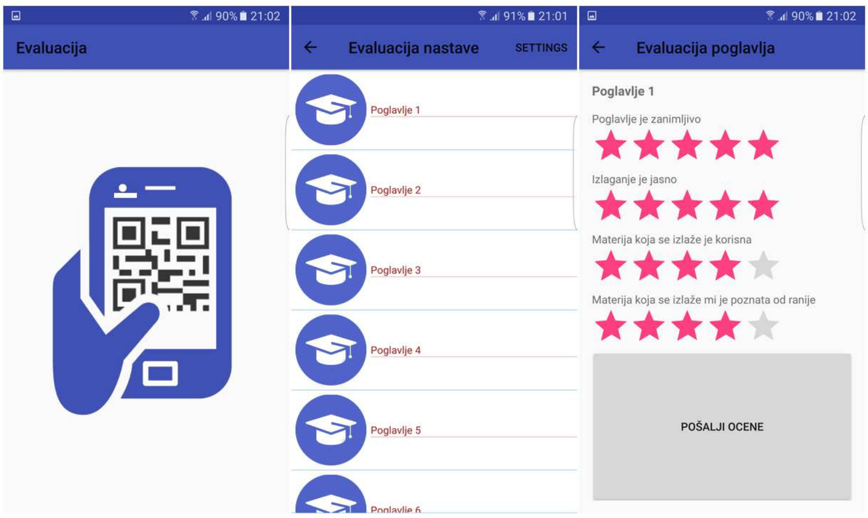

Figure 5. Screens of Android application for evaluation

4 Conclusion

Mobile phones are used increasingly in the process of e-education due to their characteristic.

Wearable technology has the potential to improve educational process, especially in medicine, to enhance the safety of children and youth and to facilitate the education of persons with disabilities. The model presented in this paper represents one of the solutions which could improve the quality of teaching by means of mobile applications for the evaluation of teaching units. At the same time, wearable device allows monitoring of psychophysical condition of students during the school day. Featured wearable device can be improved by implementing a variety of sensors to monitor vital parameters from the user's body. Further study is needed to evaluate and test the proposed and implemented system.

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Serious Games: An Oxymoron?

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Abstract

In this article, the authors will explore different genres of games and how these are being emulated to work with the "serious games" idiom. This paper also explores the technical details of a game engine and its components.

Keywords: serious games, artificial intelligence, game-based learning, development kits

1. Introduction

Serious games are being taken into account more and more for their added valuetowards the development of human skills across different subjects. Although this genre of games was developed mainly for experiments and expensive human training among big corporations or certification authorities, today, this kind of games are more affordable and can be played by anyone that owns a decently equipped (hardware wise) computer. This opennesstowards the publicgenerated more interest among casual players that try and experience the daily routine of an airplane pilot, a bus driver or even an election campaign manager. Because of their nature, serious games tend to be more detailed than mainstream games by implementing almost all the aspects of the activity that is being simulated, resulting in a real learning experience and a development of new skills that was not achievable by casual games.In the following chapters, we will discuss the current game genres and how they are emulated to work with the "serious games" idiom and the technical details behind a working game engine that can power a serious game.

2. Game types

First Person Shooters (FPS)
This specific game category includes games in which the player's perspective coincides with the main character. Most games that are included in this category are "war games" (hence the "shooter" moniker in the very name of the game type), however recently the narrative/survival game type has emerged. This particular type of game uses this perspective to introduce the player into the atmosphere.

Simulators
Nowadays the game landscape is filled with a wide range of simulators distributed across all categories of activities, such as: truck/bus driver, race car driver, airplane pilot, train conductor, farmer, etc. The purpose of these games is to mimic as closely as possible the activities listed above, both in terms of physical activities (simulating water in a boat simulator game, simulating wind and mechanics behind an aircraft in anaircraft simulator game, etc.) and procedural ones

(aviation legislation, various procedures that are carried out in the real world during that activity) in order to provide the simulator with a higher degree of realism.

There are two types of simulator games: leisure simulator and professional simulator. The first category represents simulators that can be purchased commercially and do not require a specialized computer or additional peripherals. These simulators are used by passionate enthusiasts for recreational activities or for educational purposes. These simulators do not provide the degree of simulation required to release any certification.

Professional simulators often require specialized computers, peripherals that mimic the look and behavior of different levers or joysticks used in a real machine. These simulators can reach prices of 80.000up to 200.000 [3] euros and are usually acquired by specialized training and certification centers. The level of realism of these simulators is very high in order to test participants in various emergency scenarios that cannot otherwise be reproduced outside the virtual environment.

Strategy games

Strategy games use an overview perspective and the player has the role of commander being able to control multiple characters at once.The main theme of these games used to be “war”, however, over time, they developed new components (economic, social, diplomatic, etc.) which facilitated the possibility of winning. This way the player gains new abilities that may become useful in his/her everyday life.

Massive Multiplayer Online Game (MMOG)

Online games are nowadays, by far, the most popular worldwide. Competition provided by artificial intelligence (AI) becomes repetitive and predictable, while other players can raise the level of difficulty by creating/developing/presenting new strategies, which can stimulate the player to develop their skills in order to advance in the rankings.This type of interaction between players encouragesthe player’s social side development, team spirit and experience to be a leader.Despite the fact that most commercial games are not aimed directly at educating players, the increasing level of complexity and fidelity manage to bring their contribution of new information to the player’s knowledge.

As with every domain, a new trend has emerged in the gaming community, which creates games that contain recreational and educational parts where knowledge gained by the player is tested and evaluated over time. One such an example is the game America’s Army [1]. The playergets the role of a new recruit in the US Army. To be able to play with other players online, the player must complete various practical training exercises: shooting different types of weapons, completing an obstacle course, etc. In addition to practical exercises, the game also benefits from a theoretical side where the player needs to attend different courses (first aid strategies, identifying the enemy) and then pass exams associated with each course.

3. Game architecture

A game consists of several subsystems integrated into one application called “engine”. These subsystems range from mathematics and physics libraries that allow 3D model animationto social network integration.

3.1. Game engine abstracting levels

- **Hardware.**Regardless of the device chosen to develop the game, the game engine must be able to fully benefit from the device resources, seen as how the various converters or adapters are implemented for each system architecture separately.

- **Drivers.**Companies producing video boards, develop drivers that facilitate optimization at a very low level (hardware wise) in order for game developers to eliminate the need to adapt the engine for each single type of video board/sound.
- **Operating system.** Operating systems show different libraries in order to facilitate access to necessary resources needed to run the games and the way these libraries are accessed is dictated by the "level of independence towards the platforms".
- **Third party development kits.** Over time,game developers created a multitude of development kits (SDK) in order to easier deploy elements of mathematics and physics present in all modern game engines.
- **The level of independence from platforms.**This level benefits from various implemented interfaces and adapters in order to generalize access to system functions. For example: Windows and Linux use different network libraries, but by implementing this level, programmers do not have to know any specific function of the operating system.
- **Basic systems.** This level benefits from various implemented systems for reading and writing files (data, XML, CSV, etc.), asynchronous file access systems, assertion systems, memory allocation, geographical location, media (video), peripheral devices serializer/deserializer, etc. The basic system is composed of the aforementioned systems that are necessary for operating the game.
- **The resource manager.** This level deals with loading into the game memory various resources (images, 3D models, sounds, font, game logic, etc.).
- **Rendering systems.** At this level,one can findvarious graphics libraries implemented(DirectX, OpenGL). This level is wherethe logic behind the different elements that make up the graphics engine: virtual cameras, primitive objects, static and dynamic lighting, textures, shaders, text and fonts, etc. is located. Using these elements, the programmer may display on-screen images, 3D models, he/she can transform (move, scale, rotate) and combine them.
- **Collision and physics.** Within this system,various physics related elements are implemented.These implemented elements provide a high degree of game realism.
- **The debugging system.** This system enables the programmer to access various pieces of information during the running of the engine in order to help identify errors. Also within this system, there are captured pieces of information regarding consumed resources (CPU, memory, disk access rate) which help create optimizations to use available resources more efficiently.
- **Occlusion System.** This is anoptimization system by which certain objects that are not in the player's field of vision are no longer sent to the video board to be rendered. In this way, we can increase the number of items that are not in the visual system without very crowding the system too much.
- **Visual Effects and post-processing.**This system harbors various filters and post-processing techniques similar to those affiliated to film production (HDR, color filters, blur, sepia).
- **The "skeleton"-using animation system.**One of the requirements to animate a 3D model is an invisible "skeleton" that can be created using any 3D graphics programme. This system takes over the position information of various bones and joints and applies different algorithms that allow thecharacter to move.
- **The online system.**This system hosts several implemented algorithms that allow multiple players to interact online.
- **The audio system.** This system is used to play sounds and music. It also benefits fromaudio effects, mixers that allow playing multiple sounds at once, audio filters, doppler effects, etc.

- **The display system (frontend).**By using this system, the programmer can easily implement 2D graphics that make up menus or other images intended to present the player with different statistics in real-time (score, map, ammunition, etc.).
- **Game logic level.** This level has implemented systems that allow the separation of game logic from basic game engine systems. Usually this level also benefits from scripting languages (JavaScript, LUA, Python)in order to ease the logical development of the game and to remove any engine-specific code.
- **Level specific type of game systems.** Within this level,one can find only systems related to the game itself: the rules, AI, land rendering or water simulation, etc. This is the highest level and often times when accessing this level there is no need for the intervention of a programmer, aseven a game designer can develop the game.

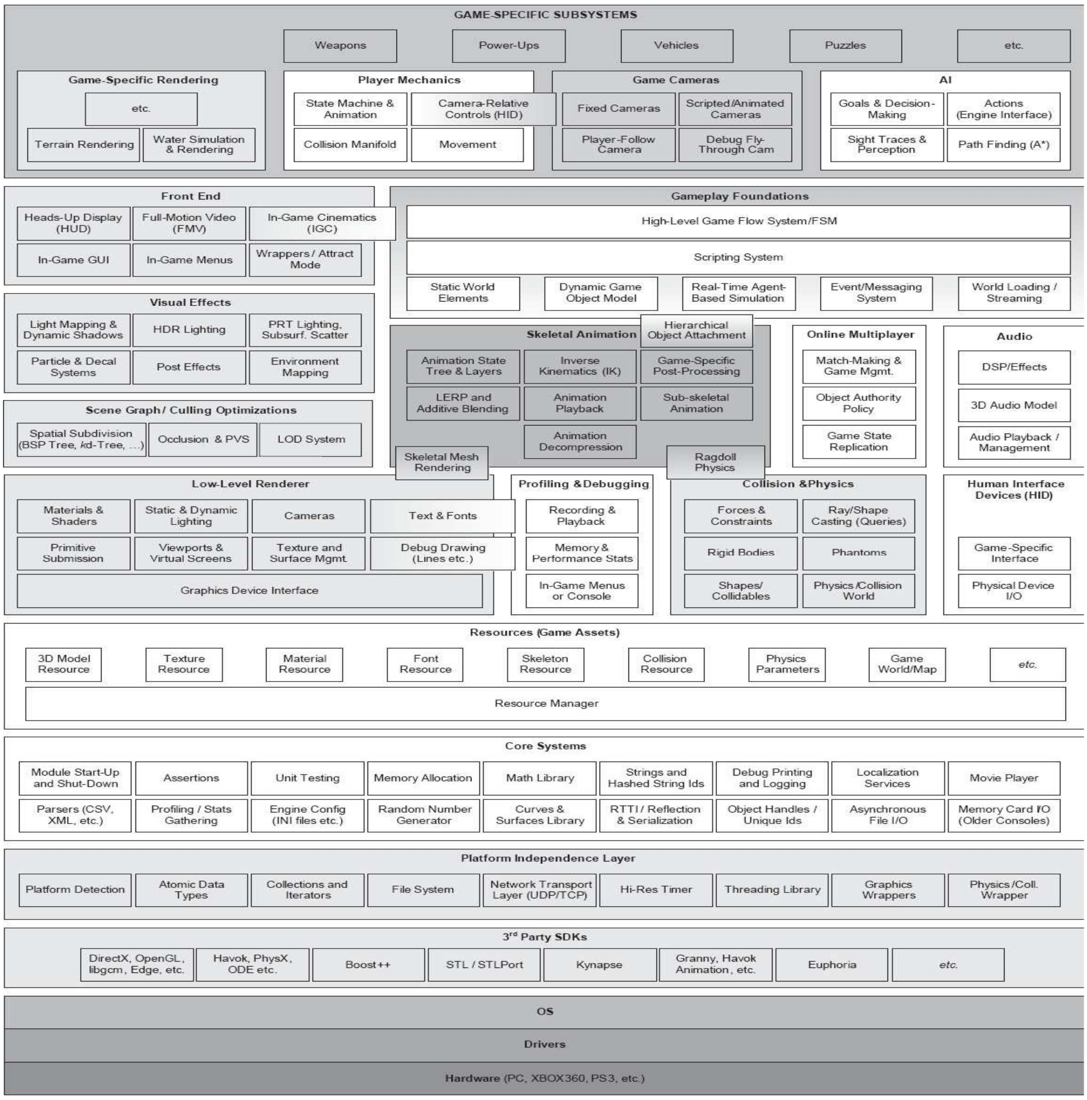

Fig.1. Game engine architecture (Source:http://www.gameenginebook.com)

3.2. Game engine types

Game engines are divided into several categories depending on the type and the degree of reusability of the game engine. Type wise game engines can be categorized as follows:

Integrated game engines. Usually this type of engines are small and incorporate game logic in its source code. This type of motor is very rigid in terms of modifiability, which limitsit to only be used for one type of game. In contrast, it allows the quick launch of the same type of game variations. Such an engine is called„Unreal" or „Source"and it provides a propitious environment for developing a FPS (First Person Shooter) type game, but it is quite difficult or impossible to develop a car simulator, for example.
This type of game engine is very specialized;much optimized and allows more rapid development of gaming platforms with limited resources. The code is used 100% and thus platform resources are used more efficiently.

Decoupled game engines. These game engines are logically decoupled and the actual implementation of the game presents the developer with different mainstream APIs that he/she can use. This type of game enginesis very flexible and because of this,it can be used to create completely different games (car simulator, platformer, FPS, strategy, etc.). An example of such a game engine is „Unity".
Naturally, this flexibility comes at a cost, which is to overload the final application with various data librariesthat the developer did not need. For example, we want to develop a game in a typical 2D space within which we do not use animation systems for skeleton-based 3D models or we do not use data libraries for simulating physics. These data libraries get to be delivered alongside the final game thusincreasing its footprint on the hard drive.
Another major disadvantage of this type of engines is represented by the fact that they are not optimized for a particular type of game due to their general nature, which can cause difficulties in developing a

3.3. Development stages

The prototype stage
The purpose of this stage is to create a very simplistic version of the game. Usually, placeholders are used for various game objects, images, sounds, menus, etc. . It is intended to test the fundamental idea of the game, whether it is as fun as it is described. Programmers and game designers perform these tests internally, and if necessary,they can call on focus groups that can evaluate the game.
For this step,the game developer uses a general and simple engine, that facilitates the designerto rapidly assemble the levels thus creating a network of small online games, the ability to easily change objects and images from the game.

The Alpha stage
At this stage,the basis for the engine dedicated to the game is laid down and the logic and algorithms that were created in the prototype stage are being implemented. The focus is on shaping graphics, replacing the placeholders with objects relevant to the game and many more components that define the basics of the game.Testing is performed internally by specialized staff (Q&A), but also by people outside the company, selected to participate in testing sessions either from home or from the location of the developer. In case the public disclosure of this stage is undesirable, the

external participants are required to sign a confidentiality agreement by which they agree not to disclose information about the game developed.
Lately, various gaming companies of small dimensions make use of the Alpha stagein order to advertise the game and to raise funds for continuing the production. The games are sold under the label "early access" and the players have access to the final game when it is finished and released. Basically the idea of paying for a place in Alpha Testing stage was introduced and this has been shown to have real success for raising funds necessary for the development of the game.

Beta Phase
At this stage 90% of all aspects of the game: graphics, designs, sounds, music, game rules, etc. have been implemented.
This stage also focuses on the discovery of possible bugs and a lot more people, specialists or non-specialists, are invited to test-play the game. There are two types of Beta:

- **Closed Beta**, in which the testing is performed by the company`s employees and also, by non-companyindividuals who receive access through invitations. The difference between **Closed Alpha** and **Closed Beta** is that the confidentiality agreement can be waived, thus allowing the external testers to publish articles about the game`s details, to perform screenshots and to be able to record videos during the game;
- **Open Beta**, here everyone can join without benefiting from any invitation or signing any contract. This method is used in order to have as many testers as possible, which can lead to an increase in data collection and error reporting.

Lately an increased desire of the players to enroll as volunteers in these stages has been observed, even going as far as invitations being sold on the black market. This depends on the popularity of the game and it usually happens in case of iterations of popular games.

Gold Stage
The game is completed at 100% in relation to the design document, the errors discovered in Beta Phase have been eliminated as much as possible and now the game is ready to be launched. Basically this is the stage where the game is set as a starting point for version 1.0 and everything that follows from now on will be game *updates* or *expansions*. An *update* can contain any errors discovered after the Beta Stage, whichare sent to players via the Internet, following that they install them by themselves.
An *expansion* is a kind of *update* with the difference that this addresses new facilities that did not exist until then in the game. These facilities may vary new characters, missions, cars, etc.
The stages listed above are part of a best practice guide. It is not mandatory for a company to follow them in that order, but most companies use this guide and methodologies precisely, thus creating a kind of standard development.

4. Conclusions

The recent emergence of “serious games” has shown the usability and popularity of this type oflearning, as casual players have been more prone to try this type of games both for educational and learning purposes. Studied literature shows a clear increase regarding participation within these games and thus this paper showcased the game architecture backbone in an effort to better understand the methods and procedures that a game developer undergoes when creating such a game.

Acknowledgments

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Computer games as assessment tests

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Abstract

Assessment is the action through which a number of elements of knowledge of the students are compared to curricula standards. In the means used, it can remember knowledge tests performed in accordance with the cybernetic-scheme of learning process: INPUT-budget, the material bases, characteristics of students / teachers, social context, energy; PROCESS (all processes) - methodology, teachers' style, educational strategies, activities that influences the students; OUTPUT - students, acquisitions and operational information, skills acquired (knowledge, skills, aptitudes), energy consumption, teaching staff/ non-teaching staff with experience enriched but elderly, dynamic society. Assessment can be achieved through assessment tests: initial, continuously or final. To remove some subjective evaluation errors, loaded by the human factor, the present paper presents an online platform "Quizlet: Learning tools & flashcard". Advantages of "Quizlet" platform are to harness the knowledge, to allow anyone to learn through play. Computer games are the most powerful learning tool.

Keywords: Instructions, Format, Submitting papers, Proceedings

1 Introduction

The changes in assessment will result in changes in learning. Increasing the difficulty level of the assessment and density of tests will not automatically lead to greater student involvement and learning. The assessment may serve as formative function. In classrooms, formative assessment refers to frequent, interactive assessments of student progress; teacher must understand and identify learning needs and to improve the teaching process.

Assessment is the action through which a number of elements of knowledge of the students are compared to curricula standards. In the means used, it can remember knowledge tests performed in accordance with the cybernetic-scheme of learning process: INPUT-budget, the material bases, characteristics of students / teachers, social context, energy; PROCESS (all processes) - methodology, teachers' style, educational strategies, activities that influences the students; OUTPUT - students, acquisitions and operational information, skills acquired (knowledge, skills, aptitudes), energy consumption, teaching staff/ non-teaching staff with experience enriched but elderly, dynamic society. Assessment can be achieved through assessment tests: initial, continuously or final.

2 Theoretical background: teaching – learning – assessment

Methodology of discipline allows the teacher to choose the most appropriate methods and procedures to verify the accurate assessment of student training and knowledge.

The process of learning can show like in following block diagram that present of four questions and answers :

Who participates the educational process?	
Professor apply methods **How to learn?**	Student learn competences **What is taught/ learned?**
Achieve goal of learning **WHY TO LEARN?**	

The answer to the question Why is taught? is found in the general goals of learning in school, namely:

- knowledge and understanding of knowledge for specific subject;
- training of practical skills and abilities, as well as some intellectual capacities, especially thinking, creativity, so they can use them in practice every day;
- specialized training both theoretical and practical of students in view of future professional guidance.

By didactic methodology of teaching - learning means the whole of methods, means and techniques of learning through which are realised the teaching-learning process and theory of efficient using of these. The didactic methodology involves the design, implementation and evaluation didactic activity.

By the design of teaching is understood:

- Classification and enunciation of the objectives pursued by a particular content.
- Teaching setting strategy, determining appropriate methods for specific content, setting of materials and means able to assist its comprehension, taking into account of how to combine methods, procedures and of educational means.

Choice of teaching strategy depends on the objectives pursued, the competencies that we want to develop, by age and the training level of pupils and a very large extent by knowledge, pedagogical tact and experience of methodical teacher. Lately as a consequence of the influence of technology over our whole life, and therefore on the formation of man, along with the term of teaching methodology also is using the didactic technology term, having the same meaning.

Through didactic method we mean a way of share or a tool through which students, under the guidance of the teacher or independently, acquire knowledge, skills and abilities, develop their psychic potential, the whole personality.

The didactic process is a particular aspect of application of the method, designed to facilitate understanding and assimilation of knowledge. In teaching (lessons, laboratory work or visiting) the teacher uses several methods and learning procedures, structured in a system and according to a formula own depending on the abilities and creativity of teacher. One of these achievements, in greater measure the didactic goal, has the largest share in the whole methodological and is considered the basic method. Others, serving this one, are used with the role of teaching processes.

The instructional techniques means all the methods, procedures, teaching aids and rules combined with personal mastery by the teacher and applied in the instruction and assessment. One can distinguish four categories of training techniques:

a) teaching techniques - consist in merge the teaching methods and procedures;
b) materials techniques - are means of education: equipment, appliances, audio-video media, school kits, teaching material of any kind etc.;
c) relational techniques - psycho-pedagogical means and rules which administer teacher-student interpersonal relationships;
d) assessment techniques - include methods, procedures and technical means and also rules by which assess the student, also, school progress achieved by it.

In the evaluation activity appears subjective judgments, which depend on factors related to:

a) the teacher' structure: halo effect, Pygmalion effect, contrast effect and personal effect.

b) the object structure; depends on the nature of the discipline, the deviations were lower in science;

c) the structure of student, his attitude in function under a) and b); here are important the moment situations of the student.

To overcome these troubles are used tests. The test is a sample or applied load on identical terms for pupils and is provided with a benchmark for individual assessment.

3 Quizlet Platform

Quizlet is a platform which offers more learning tools for every student, is a place where every teacher can share knowledge at any level for his class, in a enjoyable and interactive way, like a game. Platform has nice tools for digital age, not only for replacing traditional assessment, but using modern technologies, mobile phone, computer, audio technologies to deepen the knowledge anywhere, at school, at home or in free time.

To create an assessment game, first step is to select Create menu; after, teacher complete the boxes with title of lesson, the terms and definitions for each. After is selected Done (or Create), teacher select who can view his work: Everyone, Certain classes, People with password or Just me; and who can edit: Certain classes People with password or Just me. (figure 1)

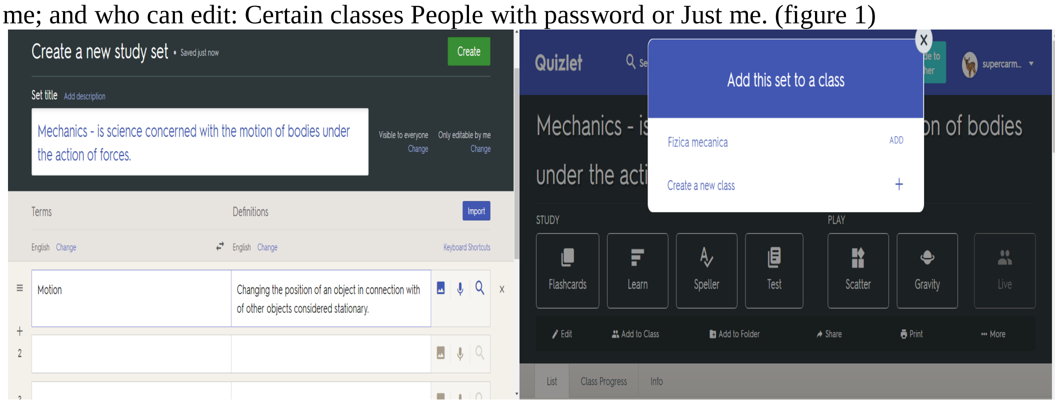

Figure 1. Create a new study set

Finally the assessment game is shared on Facebook, on Twiter for a Class (Add Class). The survey can be integrated on a folder too (Add to Folder), like part of a bigger test – Add this set to a class. Teacher can view activity and progress of students.

Quizlet has more interfaces for learn and playing for deep the knowledge: Postcards, Learn, Speller, Test, Scatter or Gravity.

3.1 “Cards” game interface

“Cards” (or Flashcards in other version) is an interface like a flayer with two sides: one side has definition that can see it and hear it, and other side has answer – the term. The player can select On/Off Audio and if knowledge starts with terms, definition or both sides on a single face. Is coached both, visual memory and audio memory. The cards can be showed in Shuffle or auto-play mode. Flashcards help to assimilate the knowledge.

3.2 “Learn” game interface

Into Learn interface is an interactive lesson, where student must complete the answer for a definition; that is shown as word or word and audio too, is seen and hear. If answer is wrong, on red line is noted incorrect and is showing both, incorrect and correct solution. (figure 2). The game runs until all the answers are completed correct.

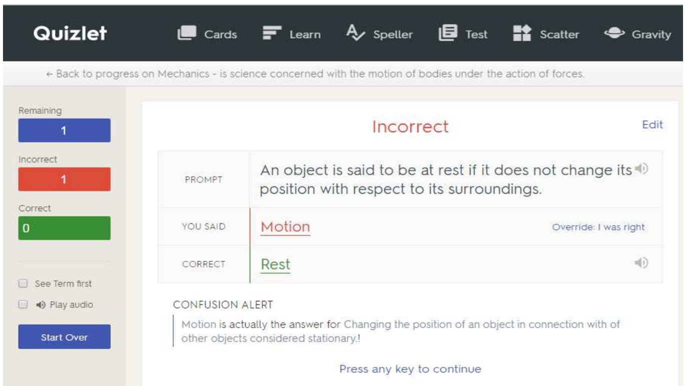

Figure 2. Learn interface

3.3 "Speller" game interface

This game helps the student to memorise the definitions or the terms in an easy and accessible way. The student needs to type what he hears under dictation. Can be selected the fast or slow mode. At the end of game, is shown the statistic of learned knowledge. (figure 3)

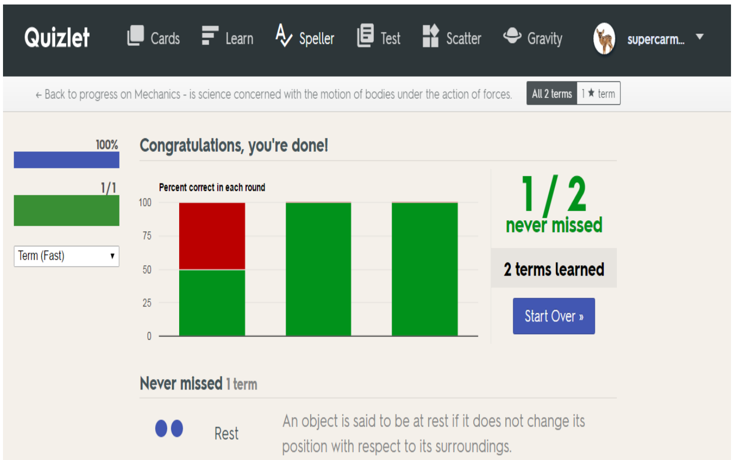

Figure 3. Speller interface

3.4 "Test" game interface

Test interface has more options; can be selected:

- Question type: Written, Matching, Multiple choice, True/ False
- Start with: term, definition or both;
- Question limit – how number of question will be completed.

Answers can be written with diacritics. After is pressed the Check answers button is shown the results, the correct or incorrect response and the progress of ended test. (figure 4)

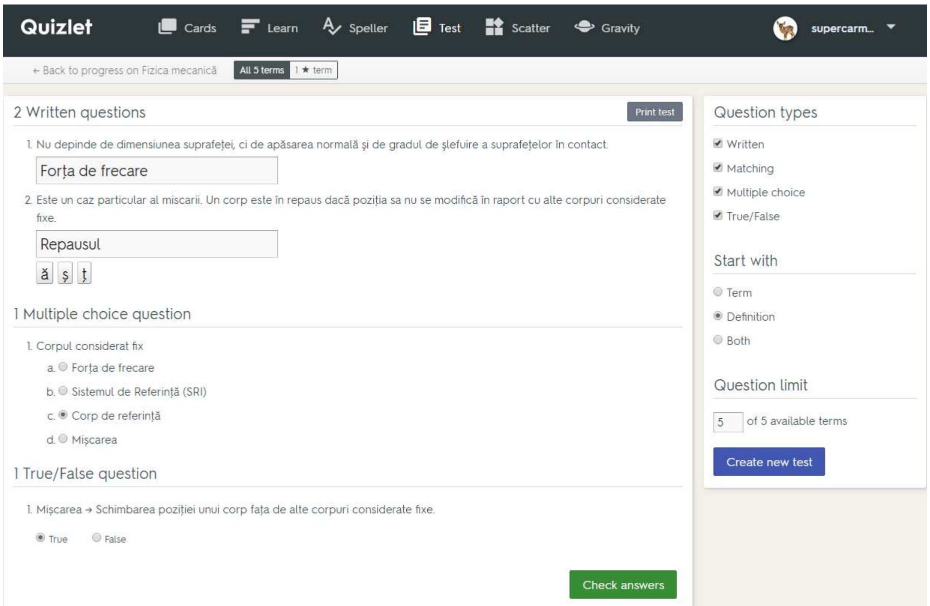

Figure 4. Test interface

3.5 "Scatter" game interface

Scatter is a wonderful game; gamer must drag the corresponding items to each other to make them disappear; to overlap the definition over the term. On screen is displayed a counter that records how quickly is completed the game.

3.6 "Gravity" game interface

Interface of Gravity game is in cosmos, where some the celestial bodies fall to a planet; gamer must protect the planet from incoming asteroids. On asteroid is writing a definition and the gamer must complete in box what term is definite. Game can be selected as difficulty level – easy, medium or hard; can be selected also if begin with terms, definitions or random. The red asteroids can destroy the planet if a term is omitted by twice. (figure 5)

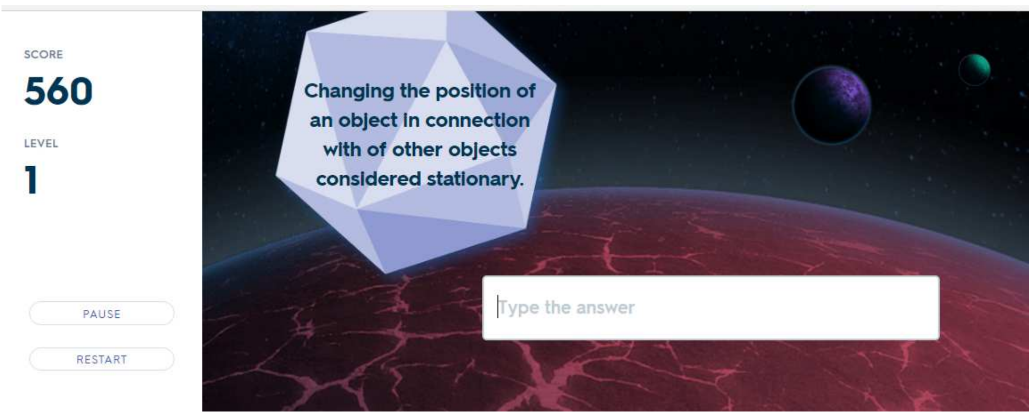

Figure 5. Gravity game interface

4 Discussions and Conclusions

All six interfaces of game are interactive and skip to have bored students. Learning through games is an activity that can be happened in class, home or in other place in free time.

Strengths of Quizlet platform for teachers:

- Class progress: can see how his students are studying and track their progress;
- Voice recording;
- No ads on his sets: students won't see teachers' ads while studying;
- Image uploading;
- Unlimited classes;
- Quizlet live customizations.

Weakness of Quizlet is linked by

- Answers must be exactly like in teacher formulation (how are recorded on platform);
- Is easily to complete terms than definition;
- On Gravity interface don't is time to complete more words – definition.

Online platform "Quizlet: Learning tools & flashcard" remove some subjective evaluation errors, loaded by the human factor. Advantages of "Quizlet" platform are to harness the knowledge, to allow anyone to learn through play.

The computer games are powerful learning and assessment tools. To a Quizlet account the teacher can create unlimited number of classes and track of students' progress.

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Temperature and Humidity Measurement System

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Abstract

The objective of this paper is to achieve a functional system in terms of hardware and software, to measure temperature and humidity.Also, this system will allow to monitoring the time. In this, we use an Arduino boardwith interfacing a sensor placed in local environment to measure temperature and humidity.The paper aims to achieve the following goals: achieving a functional system in terms of hardware and software that allows measuring and monitoring temperature, humidity and the time; using a development board for the communication with the sensor and clock; implementation a program that allows requirements.

Keywords: Arduino, Integrated Development Environment, DHT22 sensor, Real Time Clock, MaxDetect 1-wire.

1 Introduction

There heating systems that require special attention, especially in winter, when it is necessary to be constant temperature and humidity to have a desired comfort.With a data acquisition board can achieve a system that will allow monitoring temperature and humidity in a room.I used as data acquisition board, a Arduino board. Using a Arduino data acquisition board has the following advantages (https://www.arduino.cc):

- is open source;
- is easily programmed;
- can be used on any operating system;
- low cost.

Arduino boards can be programmed easily using the Integrated Development Environment (IDE). This environment is for writing programs that can be loaded on the board (Amariei, 2015).Arduino is found in several variants depending on the sizes and capabilities. The board used for this work is Arduino Uno.The difference between Arduino Uno and other boards is that this board does not use a driver FTDI USB to serial chip, but uses ATmega16U2 microcontroller that is programmed as a USB to serial converter.

Measurement and maintainingconstant temperature is important in industrial processes.Temperature transducers which are used in electrical measurements are numerous due to a wide range of temperature being measured, and because of the measurement accuracy in a specific area.

Humidity is the amount of water vapor which is contained in a sample of air. It is a very important feature of the air both in terms of weather as well as in terms of bioclimatic.Solids and liquids humidity measurement is done using umidimetrelor. They express the water content that is found in materials.In the expression of the humidity, enter the wet material mass and the dry material mass.

Humidity is expressed as follows:

• absolute humidity:

$$U_a = \frac{m_h - m_u}{m_u} \; 100 \; [\%] \quad (1)$$

• relative humidity :

$$U_r = \frac{m_h - m_u}{m_h} \; 100 \; [\%] \qquad (2)$$

Humidity measurement is based on the change of physical properties due to moisture. Moisture measurement methods are based on variation in resistivity, variation of capacity or the variation in the degree of attenuation of microwaves.

2 The block diagram of the system

Represented in Figure 1 is a block diagram of the measuring system.It contains the following functional blocks: 5 V source, 7-12 V input voltage, Arduino board, temperature and humidity sensor, RTC, battery and LCD.

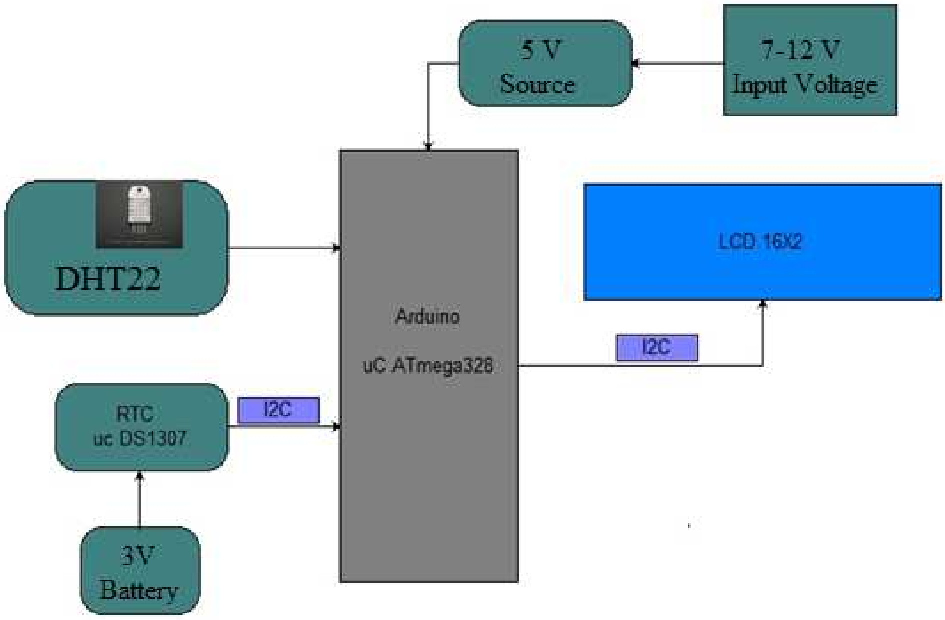


Figure 1. The block diagram of the system

Arduino block is the main block of the system. It contains development board Arduino Uno which is based on the microcontroller ATMEGA328.Arduino Uno board requires a 5V supply.The input voltage block is thepower supply system. This ranges from 7-12V.

The temperature and humidity sensor block contains the sensor for measuring temperature and humidity of an enclosure. The sensor used is called DHT22 .

RTC block contains Real Time Clock, used for monitoring time.It is based on DS1307microcontroller. When powered down, RTC uses a CR2302 3V battery type.

The LCD block contains Liquide Crystal Display used to display results. It can display 16 characters on two lines. Arduino block communicate with RTC and LCD blocks,through I2C.

3 The wiring diagram

Wiring diagram includes: Arduino Uno development board, DHT22 sensor, Real Time Clock (RTC) and LCD.

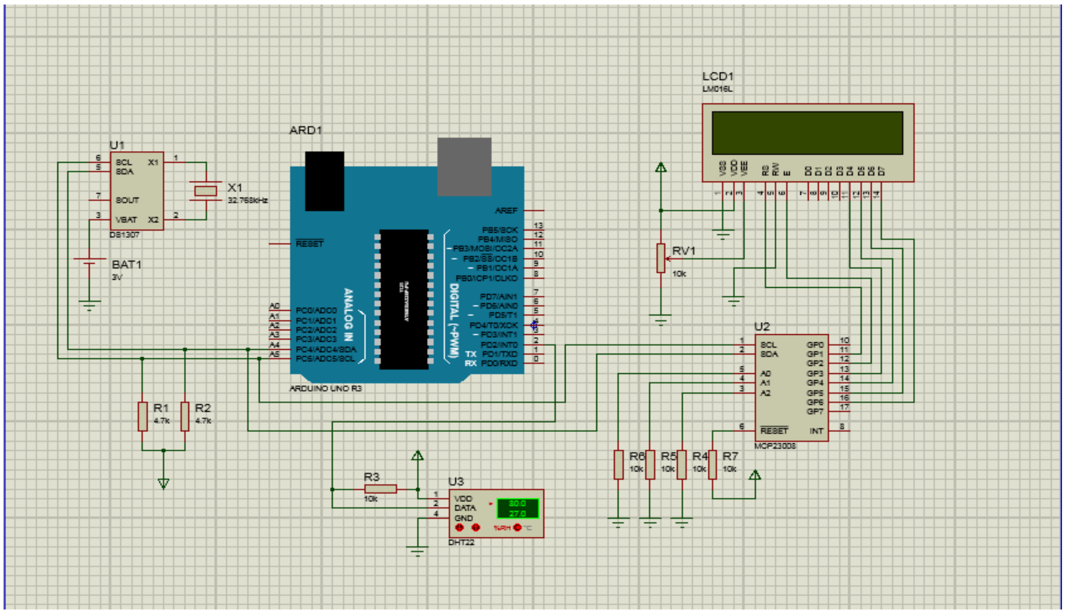


Figure 2. The wiring diagram

The Real Time Clock is based on the DS1307. The internal clock has a frequency of 32,768kHz.If power supply interruption we are using a 3V battery, type CR2302. RTC communicates with Arduino Uno via I2C.

The SDA pin of the DS1307 are connects to 4analog pin of Arduino Uno board and SCL pin of the DS1307 is connected to 5analog pin of Arduino Uno board. At the two lines of I2C communication are connects two pull-up resistors of 4,7KΩ.

The DHT22 sensor measures both temperature and humidity in the room. The working temperature is -40°C ... + 80°C and the humidity range is from 0-100%. The temperature has an accuracy of 0.5° C, and the humidity, 2%.Pin 2 of the sensor is connected to the 2 digital pin of the Arduino Uno board. Between 1 and 2 pins of the sensor it was connects a 10K pull-up resistance. Communication between Arduino Uno board ATMEGA328 microcontroller and DHT22 sensor, is made via MaxDetect 1-wire.

The LCD used can display 16 characters on two lines. Arduino Uno board communicates with it, via I2C. Communication is made via microcontroller MCP23008. LCD contrast can be adjusted via a potentiometer.

The Arduino Uno development board is powered at 5V.

3.1 Connecting RTC to Arduino Uno

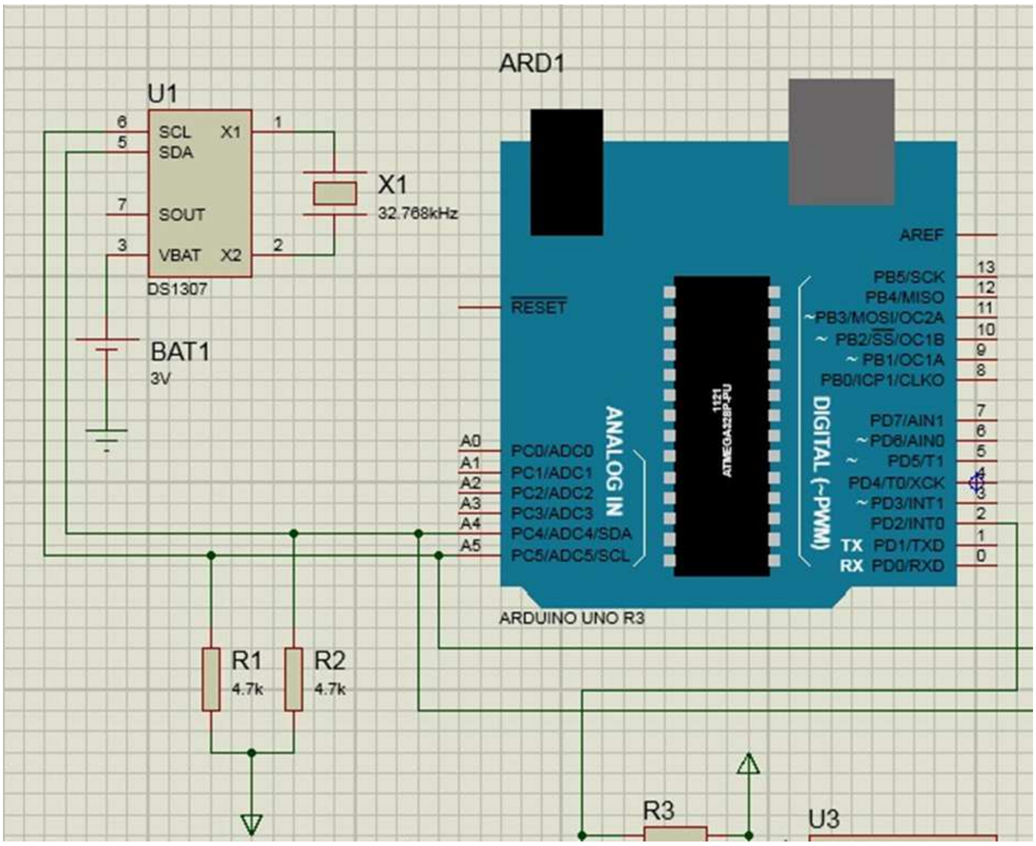


Figure 3. Connecting RTC to Arduino Uno

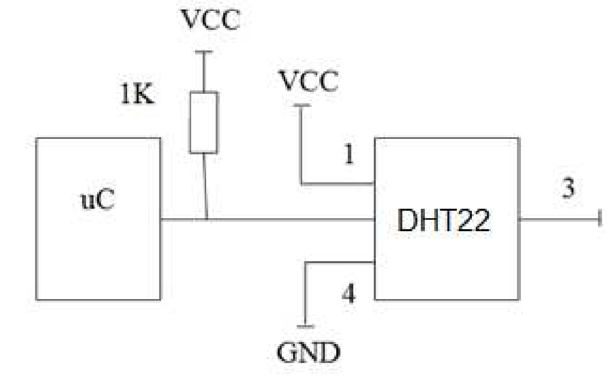
The RTC connects to the Arduino Uno board as follows:

- SDA pin is connected to a 4 analog pin Arduino Uno board ;
- SCL pin connects to a 5 analog pin Arduino Uno board ;
- a GND pin is connected to GND pin Arduino Uno board ;
- a VCC (5V) pin is connects to 5V Arduino Uno board pin;
- a SQW pin is not used.

To work with RTC,the library RTClib must be included in the Arduino development environment.

3.2 DHT temperature & humidity sensor

The DHT sensors are made of two parts, a capacitive humidity sensor and a thermistor. There is also a very basic chip inside that does some analog to digital conversion and spits out a digital signal with the temperature and humidity. The digital signal is fairly easy to read using any microcontroller (https://learn.adafruit.com/dht).



This sensor has a 4-pin :
- Pin 1 is a power pin;
- Pin 2 is data pin;
- Pin 3 is a NULL pine;
- Pin 4 is a ground pine.

Figure 4. DHT22 temperature & humidity sensor

The voltage supply must be between 3.3V and 6V (recommended 5V).Communication between Arduino Uno board ATMEGA328 microcontroller and DHT22sensor is made through MaxDetect 1-wire.

Calculation MaxDetect 1-wire: data consists of the integer part and decimal part.The formula is as follows:

DATA = 8 integer databit RH + 8 decimal data bits RH + 8 data bitsinteger T + 8 decimaldata bits T + 8 check-sumbit.

If the data is transmitted correctly, then check-sum should be:

Check-sum = 8 integer databit RH + 8 decimal data bits RH + 8 integer data bits T+ 8 decimal data bits T.

Calculation example for temperature and humidity:

After connecting the sensor to Arduino Uno board, I loaded the corresponding software for measuring temperature and humidity in the room. We obtained temperature of 20.9 °C and humidity of + 57,6RH.

The microcontroller receives 40 bits from the sensor: 16 RH data bits, 16 T data bits and 8 check-sum bits. Displayeddata were calculated as follows:

0000 0010 0100 0000 0000 0000 1101 0001 10001 0011

-Humiditycalculation:

binarRH = 0000 0010 0100 0000 ->decimalRH = 576

RH = 576/10 = 57.6%

- Temperature calculation:

binarT = 0000 0000 1101 0001 ->decimalT = 209

T = 209/10 = 20,9°C

- Check-sumcalculation:

Check-sum = 0000 0010 + 0100 0000 + 0000 0000 + 1101 0001 = 10001 0011

If the highest bit of temperature is 1, then the temperature is below 0 degrees Celsius.

4 Conclusion

Temperature and humidity measurement is essential to taking control of your environment. This functional system, in terms of hardware and software, enables us, temperature and humidity measurement of an enclosure.Also, this system monitors the time.

Arduino is an open-source prototyping platform based on easy-to-use hardware and software.The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users.

Uncertainty in temperature and humidity measurement can come from various causes. It dependspartly on the instruments, which might suffer from drift, short-term “noise”, limited resolution, and so on. Calibration uncertainty needs to be taken into account. If the conditionbeing measured is unstable, this too contributes to uncertainty in the result – forexample, temperature changes can cause uncertainty in relative humidity values (http://www.npl.co.uk/upload/pdf).

The accuracy of measurement system is0.5°C for temperature, and respectively, 2% for moisture.

Results were displayed on an LCD. This LCD can display 16 characters on two lines.They were created and displayed on LCD three symbols: a symbol for displaying temperature measuring unit (degree), a temperature icon symbol and a moisture icon symbol.

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The Simulation of the Temperature and the Humidity Measurement System

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Abstract

A number of simulation models in diverse domainshave been developed using the Proteus simulation environment.The aim of this work is to achieve a functional system in terms of software system that enables measurement of temperature and humidity of an enclosure.The software of Proteus was used to do the simulation of the designed system. By simulation, drastically reduces debugging time that would occur if the practical implementation.For the simulation of system,I used an Arduino Uno development board, an temperature and humidity sensorused as the data collector, as well as an Real Time Clock (RTC), used for monitoring time.

Keywords: Proteus, Arduino, DHT22 sensor,Real Time Clock, MaxDetect 1-wire

1 Introduction

Temperature and humidity measurement is essential to taking control of your environment.

Proteus is a design software developed by Labcenter Electronics for electronic circuit simulation, schematic capture and PCB design.Proteus is a software package for computer-aided design, simulation and design of electronic circuits.It is an electronic design application tool which can simulate microcontroller and peripheral devices. Proteus can trulyturn a complete design from concept into product.Proteus can program based on the virtual prototypedirectly. Together with display and output devices, input and output can be seen after running of programs (http://onlinepresent.org/proceedings/vol77_2014/12.pdf). The unique nature of schematic based microcontroller simulation with Proteus facilitates rapid, flexible and parallel development of both the system hardware and the system firmware.

Proteus establishes a comprehensive electronic design and development environment.It consists of two main parts, the ISIS, the circuit design environment that even the simulator VSM includes, and the ARES, the PCB -Designer.

The ISIS (Intelligent Schematic Input System) is the environment for the design and simulation of electronic circuits. The ARES (Avanced Routing and Editing Software), is a software for PCB design.

2 The wiring diagram simulation

To simulate the Arduino Uno development board and the DHT22 sensor,it should be added their libraries to the simulation program. After adding the library and realization the wiring diagram, the written code is loaded in the development environment.

Figure 1 shows the simulation project.I added an oscilloscope to display the transmitted data through I2C.

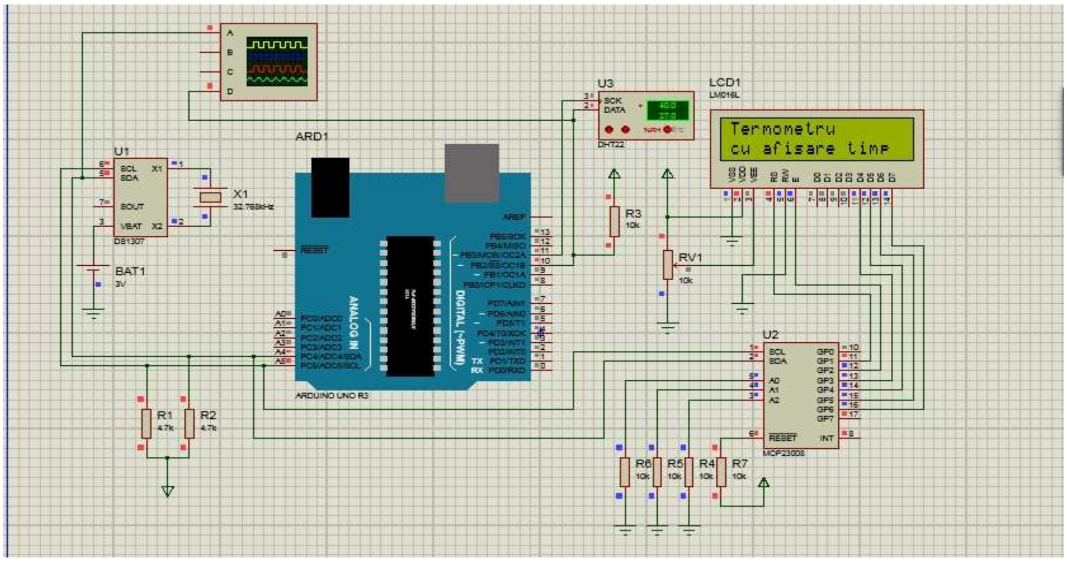

Figure 1. The wiring diagram simulation

2.1. Temperature and humidity sensor simulation

To communicate with the microcontroller, the DHT22 sensor, uses MaxDetect1-wirebus, specially designed by MaxDetect Technology Co., Ltd. Data transmitted to MaxDetect 1-wire are made from whole and decimal part.DATE formula is as follows:

DATA = 8 integer data bit RH + 8 decimal data bits RH + 8 data bits integer T +8 decimal data bits T + 8 check-sum bit.

If the data is transmitted correctly, then check-sum should be:

Check-sum = 8 integer data bit RH + 8 decimal data bits RH + 8 integer data bits T + 8 decimal data bits T.

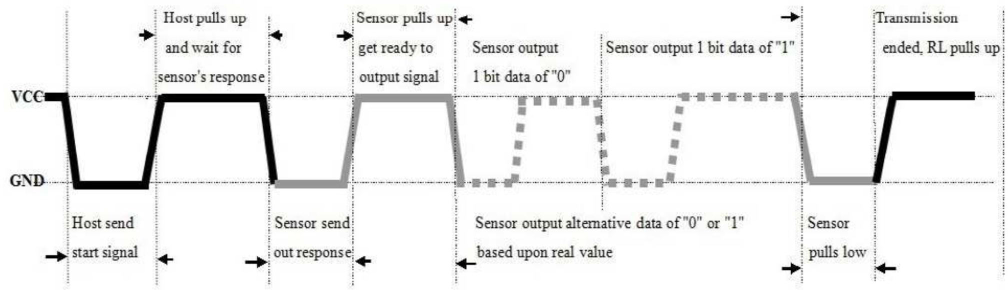

Figure 2. MaxDetect 1-wire bus illustration

Black linein Figure 2 is the signal sent by the microcontroller and the gray line represents the signal transmitted by the DHT22sensor. If microcontroller sends the start signal, the sensor changes its standby in running . The sensor will send a signal response of 40 bits of data symbolizing relative humidity and temperature.

If the microcontroller does not send the start signal, the sensor will not send the signal response.

Temperature and humidity calculation example:

If the sensor sends the following 40 bits string:
0000 0010 0000 1001 0000 0001 0010 1100 0011 1000
- Humidity calculating
binar RH = 0000 0010 0000 1001 -> decimal RH = 521
RH = 521/10 = 52.1%
- Temperature calculation:
binar T = 0000 0001 0010 1100 -> decimal T = 300
T = 300/10 = 30°C
- Check-sum calculation:
Check-sum = 0000 0010 + 0000 1001 + 0000 0001 + 0010 1100 = 0011 1000

In the figure below you can see the signal transmitted on MaxDetect 1-wire bus. Once microcontroller initializes start of transmission, the DHT22sensor sends the 40 of the bit response.

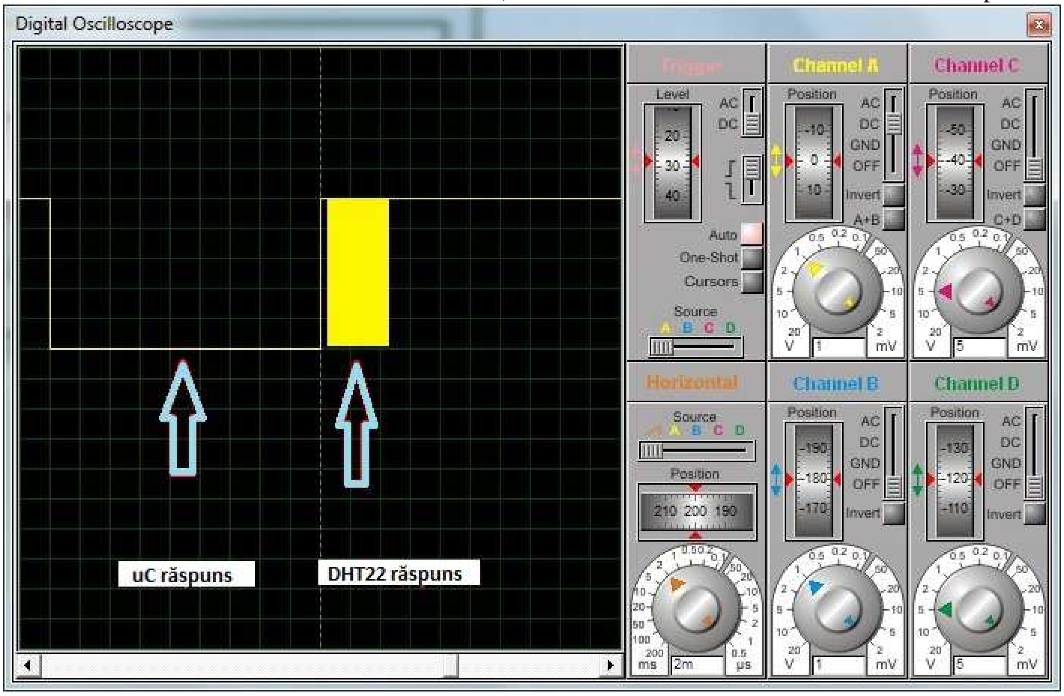

Figure 3. DHT22 sensor oscilloscope simulation

2.2. Real Time Clock simulation

Arduino Uno board communicates with the DS1307 through I2C. I connected an oscilloscope on two specific I2C lines communication, to see the transmitted data.
In Figure 4. it can be seen RTC simulating. The LCD displays time and date.

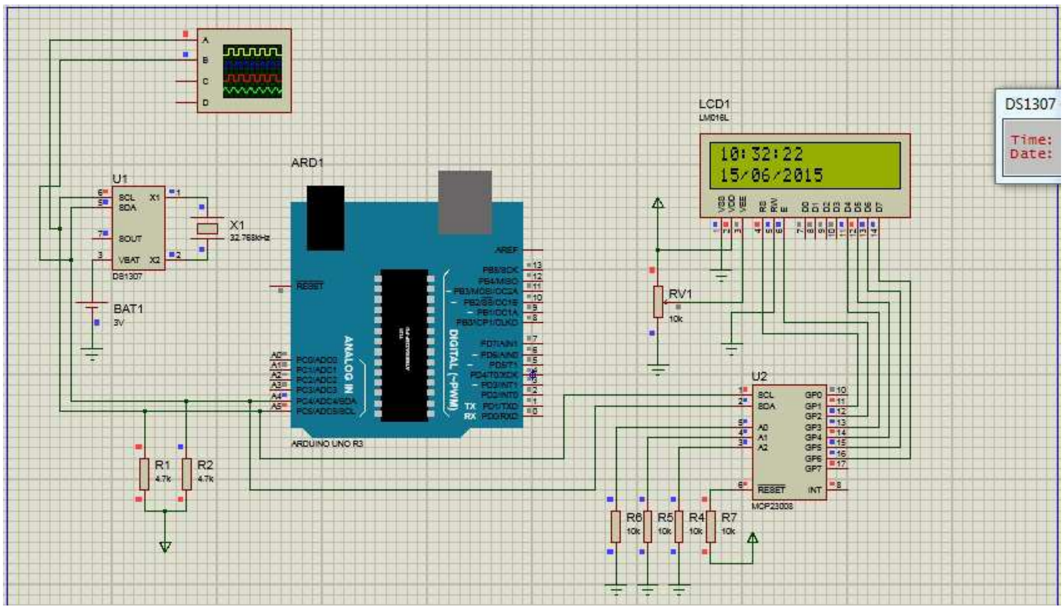

Figure 4.Real Time Clock simulation

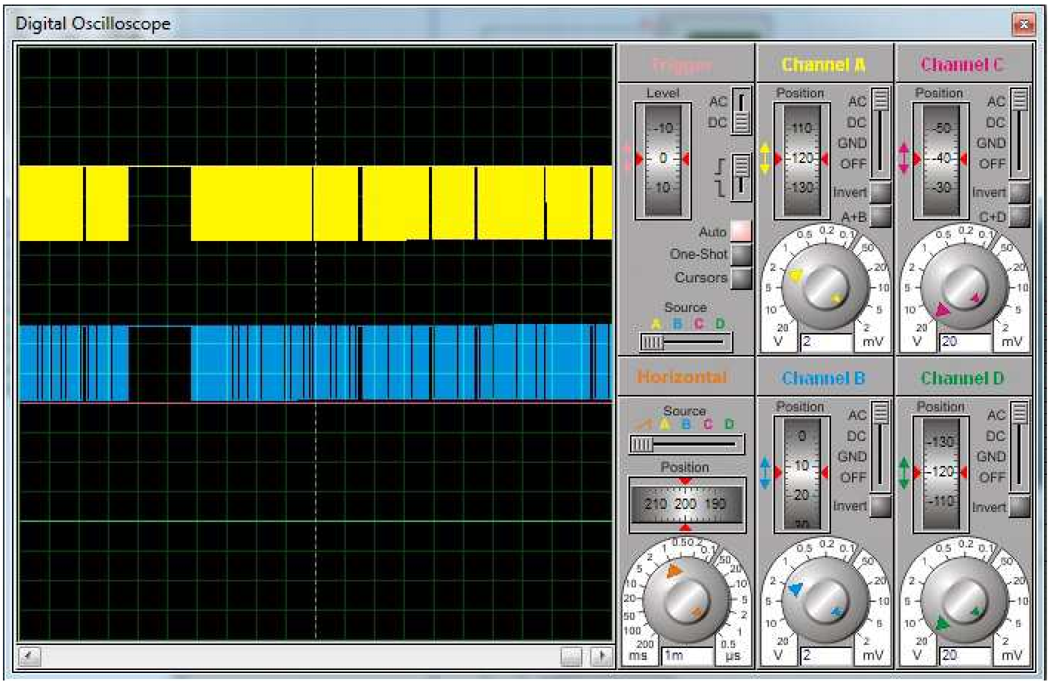

Figure 5.Real Time Clock oscilloscope simulation

In Figure 5,can be observed the transmitted data on I2C specific lines communication. Signal yellow line represents the clock (SCL) and blue signal representing the data line (SDA).

Conclusion

I am used the program Proteus software to simulate the project and to evaluate the design's feasibility and stability.Temperature and humidity simulating system was designed by PROTEUS software. The MCU ATmega16U2 was used to control the whole system. The humidity and temperature sensor DHT22 was used as the data collector. The system compare the collecting temperature and humidity data with their normal value to decide whether modifying the temperature and humidity or not.

Design and development costs for such systems couldbe significantly reduced if only there were efficient techniquesfor evaluating design alternatives and predictingtheir impact on overall system performance metrics

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Open Online Training for Humanitarians: the Pedagogical Background of RCRC Learning Platform

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Abstract

The Learning platform made available at ifrc.org/learning-platform by the IFRC since 2009 remains a cohesive space for the common Red Cross and Red Crescent (RCRC) repository of online learning, an important vehicle for the lingua franca of the RCRC knowledge and a gateway to professional and personal development for people in the RCRC Movement, as well as for humanitarians at large. This article presents the main pedagogical principles and assumptions guiding the development of the learning offer for volunteers and staff.

Keywords: e-learning, pedagogy, learning platform, humanitarian work, preparedness

1 Context and Introduction

As nowadays people and organisations are moving forward at a rapid pace and the challenges are becoming more and more complex, characterised by a significant dose of risks, uncertainty and unknown, the solution to remain efficient and competitive, delivering quality services for beneficiaries, is to continuously learn, in order to keep up with the changing context and to innovate or to improve the way of delivering services, the working relationships, the solutions to old and to new problems, the mechanisms in place to efficiently achieve goals.

In the landscape of online learning in humanitarian area, Red Cross and Red Crescent Movement has its particular place, the learning ecosystem`s growth being continuously nurtured by the volunteers and staff` learning demands, on one hand, and by significant investments in the development of punctual projects targeting specific training needs, to be deployed either using a blended approach, complementing face-to-face traditional sessions with online, either entirely as distance learning, on the Internet. Red Cross or Red Crescent National Societies, the International Committee of the Red Cross, the International Federation of Red Cross and Red Crescent Societies (IFRC) are making efforts to augment the skills of human resources involved in humanitarian actions and operations, and, sometimes, to systematise their learning paths by building interlinked competency frameworks, curricula, evaluations.

Hard work, past successes, competent human resources, care for others and for improving own capacity to help, confidence in humanitarian goals and ability to transfuse authentic values and hope to others – these are core elements supported by the organisational culture, more or less visible in most of the Red Cross and Red Crescent organisations and reflected in the quality of humanitarian services provided to individuals, communities, states.

The online learning programme built by the IFRC and available for free on ifrc.org/learning-platform is offering development opportunities to the Red Cross and Red Crescent volunteers and staff, helping them to broaden their understanding, to strengthen their organisations, and to be better prepared in providing humanitarian aid.

More than 200 online courses, each in 5 languages on average, are available for free, lasting from 30 minutes to several hours. Starting with 2010, there were around 483,000 registrations to courses and 218,500 completions, with an overall rate of completion of 45%. In total, the users of the platform have spent over 102 million minutes in courses – which is more than 71 thousand days or 195 years in learning – figures that are showing the great interest raised and the scale of the programme.

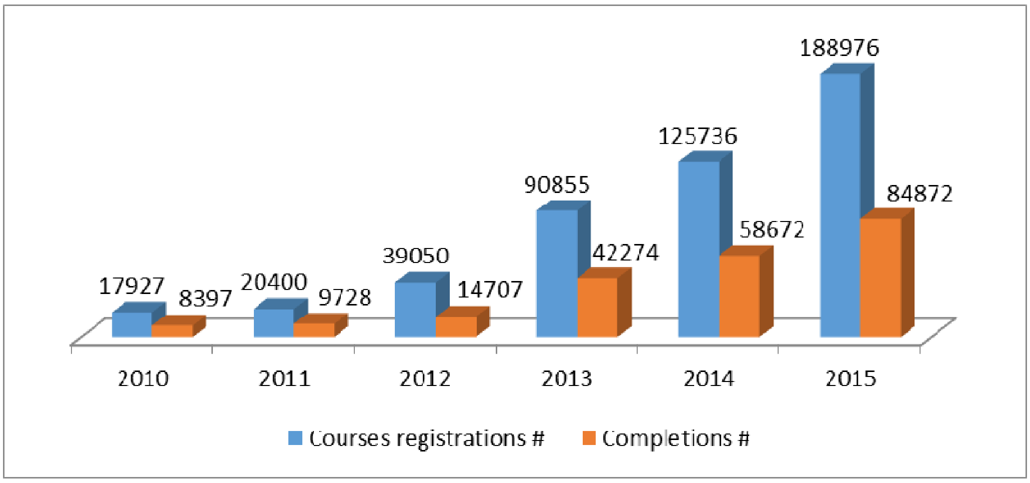

Fig.1. *Number of courses registrations and completions, per year*

The most attractive training sessions are the ones directly related to Red Cross and Red Crescent areas of focus, in domains such as Volunteering and Disaster management:

- "*Stay Safe - Personal Security*" (55,735 registrations since the launch in Nov. 2009), a 2.5 hours course, available in English, French, Spanish and Arabic
- "*Volunteering – Basic Course*" (38,844 registrations since Oct. 2012), a 1 hour course, available in English, French, Spanish, Arabic, Portuguese, Russian
- "*The World of Red Cross and Red Crescent (WORC)*" curriculum, (34,270 registrations since August 2010), 20 hours, in English, French, Spanish, Arabic
- "*Stay Safe – Volunteer Security*" (15,646 registrations since Oct. 2013), a 2.5 hours course, in English, French, Spanish and Arabic
- "*IDRL - Introduction to International Disaster Response Laws, Rules and Principles*" (10,835 registrations since Jan. 2011), 30 minutes, in English, French, Spanish, Arabic, Russian,

but being complemented as well by some general courses in Personal development or in Professional development sections:

- "*Assertiveness: know your profile*" (2,322 registrations), a 30 minutes online course available in 6 languages
- "*Fostering and maintaining motivation*" (1,664 registrations), 30 minutes, 12 languages
- "*Project management essentials*" (703 registrations), 30 minutes, 10 languages
- "*Improving communication by adapting to others*" (698 registrations), 40 minutes, 4 languages
- "*Increasing your productivity in a fast-paced world*" (594 registrations), 30 minutes, 5 languages.

A number of more recent courses, such as "*Preventing Corruption in Humanitarian Aid*", "*Contingency Planning*", "*Emergency Needs Assessment*", "*Health Care in Danger*", "*Introduction to Monitoring and Evaluation*" are keeping the pace, becoming leaders of audience in monthly analyses.

Learners on the RCRC Learning platform are very satisfied with the achievements and the learning experience. At completion, 82% rate the learning path undertaken as excellent (54%) or above average (28%). 44% agree and 48% strongly agree that they are **better able to apply the respective skills and knowledge in their professional area**. 95% would recommend the courses to a colleague (number of respondents N=72,11).

Three months after completion, 86% of our learners consider what they learned helpful (50%) or very helpful (36%) for their professional work. They declared **the courses enabled them to play a more supportive and constructive role** in contributing to the organization where they work, to a great extent (50% of the learners) or to a moderate extent (34.5%) (N=5,126).

2. The Online Learning Programme

The online learning programme can be defined as a suite of activities circumscribing the RC&RC Learning platform, aiming to provide training opportunities for every volunteer and staff member around the world. Endorsed by a decision from 2009, the IFRC`s programme "*supports individuals and organizations with their lifelong learning. It stimulates new thinking, sets new standards, and establishes a range of curricula that are relevant to the Movements' core business areas and beyond.*"

The general goals of the programme were maintaining their value over time, undertaken by a significant number of National Societies:

- to change minds for the better by facilitating high-quality learning opportunities and outcomes for all Red Cross Red Crescent volunteers and staff;
- to provide a world-class education in humanitarian and development issues, practice, thinking and values – to anyone, anytime, anywhere;
- to help strengthen individual competencies and a collective understanding of the Red Cross Red Crescent Movement;
- to build a global community of knowledge on humanitarian and development issues.

2.1 The Learning Platform – Training Offer and Audiences

The available training offer on the RCRC Learning platform is broad, fairly covering the continuous professional development needs of RCRC volunteers and staff to a sufficient level and extent. More than 200 self-paced online courses, each with 5 language versions on average, are kept available for free, relying on a considerable effort on behalf of IFRC.

The RCRC courses are developed by IFRC subject matter experts, National Society expert teams and third-party technical developers, following a specific standard operation procedure elaborated by the Learning and Research Department in 2014. Within the development process, the main tool used is the "Checklist for new online courses development" comprising 30 criteria related to relevance, accessibility, pedagogical approach, content, and institutional value (Istrate & Kestens, 2015).

The "structure" of the Catalogue is following a topic-based approach, being as well convergent with various attempts to build core humanitarian behaviours and competency taxonomies, for example the matrix elaborated by CBHFA of six core competencies essential to all staff in emergency response (CBHA, 2012):

1- Understanding humanitarian contexts and application of humanitarian principles;

2- Achieving results effectively, considering the need for speed, scale and quality;
3- Developing and maintaining collaborative relationships;
4- Operating safely and securely in high risk environments;
5- Managing yourself in a pressured and changing environment;
6- Leadership in humanitarian response.

However, the "audience groups" of the platform are heterogeneous, including for instance volunteers with very different backgrounds, preparedness, areas of work, and expectations – therefore a single framework matching all needs, desires and levels of readiness is difficult to establish. There are more than 194,000 accounts on the RCRC Learning platform, out of which more than 95,000 are currently active users. The distribution by affiliation is restricted to the given categories available at registration on the platform – except for IFRC staff affiliation being a self-declared variable – i.e.:

- Volunteer RC/RC National Society (52%)
- Staff RC/RC National Society (17%)
- Staff IFRC (including former employees) and staff ICRC (8%)
- Staff United Nations Organisation (1%)
- Staff/ Volunteer Non for Profit (3%)
- Other affiliation (19%).

Over time, the platform turned out to be a veritable gateway to professional and personal development for a wide variety of people in the RCRC Movement (77%), as well as for humanitarians in general (23%). Many international NGOs explicitly direct their staff and volunteers to the RC&RC Learning platform to take courses as a mandatory step before being deployed in the field, as part of their career path or simply to further develop their understanding of the humanitarian preparedness and operations landscape.

More than half of the users are **RC/RC volunteers**, a total of more than 101,000 accounts, out of which 54,000 accessed their accounts in the last 12 months, being therefore counted as "active learners". The best represented countries are United Kingdom and Mexico (each with around 30,000 volunteers), then Australia, Ecuador, Sweden, Columbia, Argentina, Italy, and United States.

Table 1. *Accounts created by volunteers on the LP, by regions (%; N=101,730)*

	101,730	
Africa	5,511	5%
Americas	40,394	40%
Asia Pacific	13,349	13%
Europe and Central Asia	39,355	39%
Middle East and North Africa	3,121	3%

From the total number of accounts, 17% is comprised of **staff** in Red Cross or Red Crescent National Societies around the world. Here, countries like United Kingdom, Australia, Mexico, Sweden and France have the highest numbers of learners, being seconded by US, Canada, Spain, Philippines, Japan, Kenya, Colombia etc.

The Learning platform is used nowadays in all National Societies, receiving approximately 10,000 new course registration requests and 5,000 course completions every month.

Table 2. *Evolution of interest to courses, by audience group*

	All learners		**Volunteers RC/RC**		**Staff of RC/RC National Societies**	
	Registrations #	*Completion %*	*Registrations #*	*Completion %*	*Registrations #*	*Completion %*
2010	17,927	47%	3,534	51%	4,487	55%
2011	20,400	48%	6,517	50%	6,357	53%
2012	39,050	38%	14,545	43%	11,551	34%
2013	90,855	47%	51,940	50%	13,298	45%
2014	125,736	47%	72,092	49%	24,760	46%
2015	188,976	45%	104,271	46%	40,485	48%
2010-2015	***482,944***	***45%***	*252,899*	*49%*	***100,938***	***46%***

2.2 The Pedagogical Background

Since its beginning in 2009, the initiative of offering RCRC volunteers and staff relevant training was putting stress on development of online courses of the highest quality, taking into consideration several elements which were improved in time, based on the experience and on the competencies of the human resources involved in the learning projects. The framework for developing new courses have therefore several well-established pillars:

- The learning path`s outcomes should be focused on being able to **apply**, rather than to remember information. In general, the learning objectives should vary by level, aiming the development of higher-order thinking skills as much as possible.
- Learner`s capacity to **transfer** the models of action into other situations and in other domains should be developed.
- Learner should afterwards be able to act as a resource person and to further train others, in real-life situations; **changes in attitude and behaviour** should be targeted throughout the learning paths, by various means.
- Online learning materials should embed **active learning methods** to a satisfactory degree – depending on the topic, learning time, learning objectives; in this sense, priority should be given to (cognitive) interactivity, purposed for learning, rather than to “functional”-type navigation interactivity.
- **Integrative** approaches are preferable, treating the themes from multiple complementary or divergent perspectives and providing with a holistic approach to the subjects in focus.
- **Interlinking** courses and resources (of different nature, in different formats, from different platforms) helps building a significant and complete picture by the learners, a better understanding, and thus nurturing the feeling of belonging, to global as well as to local communities.
- Different levels of **difficulty**, depth and specialisation should be taken into account and offered as alternatives, especially within the RCRC domain-specific listing of courses.
- A certain level (up to 30%) of **variance and divergence** is beneficial considering the curricular components, starting with the visual design or technological solution and ending with the interpretation of the content (regardless if this is information, procedures, models of action, ways of thinking etc.) and with the pedagogical treatment of the content (deductive-inductive, analogic, algorithmical, transmissive-heuristic, interactive etc.).

While some of the courses fully succeeded in being aligned with the latest pedagogical and technical requirements, still able to score very high on any evaluation rubric developed by the most exigent professionals in the field, in the development of some others the teams involved were constrained to make compromises mainly due to limited (if any) budgets and time available. However, the main scope of covering a training gap was pursued, as the early stages of "putting resources on the empty shelves" can indulgently short-circuit some technical or pedagogical benchmarks especially when planning for future amelioration based on the initial results.

Some additional requirements or recommendations were set to accommodate the heterogeneous environment of the worldwide Red Cross and Red Crescent:

- The most disadvantaged target groups should have priority, given that (among other things) some countries still struggle with access to technology and Internet, therefore: focus on essential, short is better, language should be accessible, as many language versions as possible, "heavy" resources should be optimised and alternatives should be provided whenever possible etc. It is assumed that volunteers and staff having good access to technology have as well access to educational alternatives (accessible on-line) and multiple possibilities to develop the necessary personal and professional skills. However, when it is possible, the learning path should be differentiated and personalised considering various audience groups.
- A shared responsibility and ownership for the courses is preferable (proving its efficiency over time) – involving technical teams, National Societies, Reference Centres, partner institutions from the academic sector, sometimes IT companies – within the development process mostly, but throughout the entire lifecycle of the online resources.

Several theoretical anchors, briefly described here in an eclectic manner, are guiding the activity of developing a meaningful and coherent virtual training space for RCRC volunteers and staff. The theoretical foundations are set mainly from an utilitarian perspective (Velea & Istrate, 2011), defoliated of interpretations and recent developments, to serve as levers for a very practical mission of building, with limited resources, a powerful and comprehensive training tool to reach hundreds of thousands.

Constructivism is a learning theory based on the observation that people build their own understanding and knowledge of the world through experience and reflection. In training, participants actively learn by doing, for example, experimenting and solving specific problems of the real world. They reflect on how their understanding changes and discuss about it. Project-based learning, inquiry-based learning and problem-based learning are rooted in the constructivist approach. Learners work on projects or open problems, usually for a long period of time, searching multiple sources of information and creating authentic products or imagining solutions to real-life problems. (Velea, 2011)

The premise of the **interdisciplinary approach** to the content of learning is to ensure unity of knowledge and overcome the boundaries of the fields of study. "In everyday life, our challenges are complex and unitary, so we approach a situation in an integrative matter, from the perspectives of different disciplines, interrelated and, moreover, capitalizing on formal, non-formal and informal learning." (Velea, 2011) Pedagogical literature offers several methodological solutions: multidisciplinary and thematic approach, interdisciplinary and integrated approach, cross-curricular approach. An interdisciplinary perspective facilitates the shaping of „a unified picture of reality" and the development of "integrative thinking". Interdisciplinary correlations are links between fields of study, meaning that explaining a phenomenon is requiring information gathered from different knowledge domains and methods. They can be spontaneous or (preferably) planned and can be linked to the definition of concepts, the use of methods or tools in new contexts, the transfer of values and the formation of attitudes across different domains.

One of the most appropriate method for an interdisciplinary approach is the project based learning method (PBL).

Adult learning is best described by several characteristics (Knowles, 1984) such as:

- the need to link learning with the experience and the prior knowledge of learners; learning is not predominantly a process of accumulation, but a restructuring one, a development and generalization, and adult learners feel the need to relate theories and concepts with their own experience that they want to exploit – inductive strategies are therefore preferred;
- independence and motivation in learning: adults need a different guidance, a nondirective one, they need support; their motivation is intrinsic and related mainly to the profession;
- learning oriented to a goal: adults want to know very clearly and right from the beginning why and for what they are taking a course;
- relevance of learning: adults seek to understand the applicability of knowledge and the value of what they learn in terms of their social or professional life; learners should be allowed to choose topics and learning paths according to their interests and needs;
- pragmatism: adults find and select the most relevant and useful aspects/ knowledge/ skills, according to their own identified needs.

In addition, it should be accounted that adults:

- need to be respected and their experience to be acknowledged;
- expect high-quality instruction, and not just arbitrary training;
- have busy lives and little time to waste;
- may have unpractised learning skills;
- may be resistant to change.

Based on these main characteristics of the learning process for adults, some techniques can be extracted in order to **facilitate learning** by using the constructivism, integrative approach and PBT method:

a.) identification, valuation and use of the previous personal experience – based on the initial learning needs analysis and description of the targets group(s);

b.) treating learners with respect and creating an environment based on trust and cooperation – aspects favoured by techniques such as asking for opinion or possible solutions, providing timely feedback, working in small groups (if social learning tools are available);

c.) orientation of the training towards practical solutions and clear goals, relevant to the profession of the participants (learners could be involved in management of the training process);

d.) encouraging reflection on their experiences and extracting "lessons";

e.) involving learners in activities by ensuring premises such as relevance of the content, by encouraging them to design their own tasks, by fostering the exchange of experience, collaboration and small groups work – could be set up as follow-up activities, after the (online) training;

f.) maintaining learners` motivation during training and after the training (because motivation is supporting attention, stimulates and guides their learning, being as well the main driver for changes in their behaviour).

Some issues which may impede the learning process can be identified and could be taken into account when designing, implementing and evaluating a training programme for adult learners:

- previous experience - often an asset in adult education, it may nevertheless lead to reverse consequences due to the "already know" sensation or the effects of previous failures in learning (the feeling that the training does not help, that is theoretical and not applicable, that it does not justify the time spent, that it is difficult and will not meet the requirements etc.);
- misconception that learning is specific to early ages and not to adults is sometimes a way to mask the fear of not cope with new requests for training, especially the fear of new technologies;
- lack of motivation, feeling that training will not bring benefits to deserve the investments;

- fear that their image could be affected, that could be perceived differently by others and judged on their performance in the training process – especially when the social status is high;
- lack of exercise to learn, to work in groups, to collaborate.

3 Conclusions

The responsibility of developing volunteers and staff` competencies is (and should be) equally shared among stakeholders – in this case, National Societies, IFRC, and the volunteers and staff themselves. In this perspective, there are several levers that can be used for a meaningful implementation of a learning programme of this scale, to assist the sustainable growth, including correct alignment and interconnections with other horizontal and hierarchical areas:

Partnership agreements. Shared commitment from all parties, concerning each sequence or piece of the online learning programme, is crucial for the overall success. Furthermore, collaboration with academia and peer institutions is a guaranty of the quality of the training offer. *How can RC/RC organisations better converge their efforts towards establishing authentic and sustainable shared learning environment(s)? How we can link up with various partners to channel shared values and know-how and build on the experience of networks and systems currently in place, such as ALNAP, Sphere, LCP etc.?*

Quality standards. The guidelines and indicators for quality assurance are at the core of the design, development, implementation and evaluation processes, as QA is pivotal in ensuring the main goal of human resources development – one cannot and should not seek for a compromise in establishing and in confirming compliance with standards. Specific mechanisms have to be put in place to ensure consistency, such as validation checklists, rubrics, evaluation templates for different types of stakeholders. Small omissions in the workflow of developing and maintaining courses could have important effects, some of them detrimental to the experience of learners and affecting negatively the outcomes. Case studies and use cases, covering the entire learning project cycle, could be useful in demonstrating to the course owners, subject-matter experts, online course project coordinators, technical teams, and decision makers the advantages of adhering to the established quality standards – as it is not always easy to grasp nor obvious for them.

Data availability. Accurate, comprehensive and timely data is useful not only to inform the direct stakeholders (including learners), but to correctly inform policy decisions regarding other intervention programmes, allocation of funds, recruitment etc.

Thoroughly looking at the online learning programme set up for all volunteers and staff in Red Cross and Red Crescent, it can be said that considerable progresses have been made in all fronts in the last years, even though, at least when talking about a more formalised and scientific approach, one could notice there are several key-components missing, such as: a unifying competency framework mapping the skills, knowledge and values of Red Cross and Red Crescent volunteers and staff, a (formalised and widely endorsed) learning strategy to establish goals and to weight formal and non-formal, face-to-face and online, mandatory and optional learning, and full support from management towards establishing an authentic learning culture and a specific mindset. The main lesson learned from the experience of designing and developing a large-scale online training programme for such a diverse audience consists in the imperative of carefully establishing the underpinning pedagogy and the quality assurance mechanism, based on the overall philosophy, organisational needs and context, strategic learning and development plan, and, not least, on the changing needs and expectations of nowadays learners.

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A Journey to Diversified and Personalised Learning: The Red Cross and Red Crescent Online Learning Platform – Evaluation Results

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Abstract

With more than 100,000 learners, 200 courses, and 5,000 completions each month, the Learning platform made available at ifrc.org/learning-platform by the IFRC is the largest online learning platform in humanitarian domain.This paper gathers the results of an intermediate review purposed to support the amelioration of the Red Cross and Red Crescent online learning programme by depicting the needs and trends in competencies development for volunteers and staff, based on the analysis of the online learning activities during 2010-2015. The results presented are relying on the feedback from beneficiaries learning online, capitalising upon the introduction of the evaluation system: a satisfaction questionnaire at completion, set up in mid-2014, and an impact questionnaire triggered 3 months after completion of each course, set up at the beginning of 2015. The analysis is part of the continuous efforts to provide quality, meaningful, updated, timely and convenient personal and professional development opportunities to Red Cross and Red Crescent volunteers and staff around the world.

Keywords: e-learning, training programmes, online learning platform, humanitarian work, volunteers training, learning evaluation

1 Context and Introduction

To the Red Cross and Red Crescent (RCRC) volunteers and staff, the online learning programme(s) built by the IFRC and available for free on ifrc.org/learning-platform is offering development opportunities to broaden their understanding, to strengthen their organisations, and to be better prepared in providing humanitarian aid.

To date, more than 200 online courses, each in 5 languages on average, are available on the global RCRC Learning platform. They are free, self-paced, with proposed learning time from 30 minutes to several hours. Starting with 2010, there were around 483,000 registrations to courses and 218,500 completions, with an overall rate of completion of 45%.

The evaluation data presented in this article shows that there are significant progresses in developing RCRC human resources, a very high interest for learning from the humanitarian professionals at large, and very promising outcomes regarding the extent to which the offered online training is enabling RCRC volunteers and staff to play a more supporting and constructive role within their organisations, therefore there is a need to continue, expand and capitalise more on this invaluable asset.

2 Monitoring and Evaluation Tools

While learning and organizational development is more and more becoming a priority, the expansion of number of users and available resources consequently augments the challenges that the learning & development team have. One of the biggest challenge is the ability to monitor the training services provided, as the core of the IFRC`s efforts to provide relevant, up-to-date, quality education and training for Red Cross Red Crescent volunteers and staff.

The whole IFRC`s online training programme initiated in 2009 was not going into an evaluation process until recently. In 2014, an evaluation framework was set up, building on Cornerstone platform available tools and aligned with the most widely used theoretical foundation – Kirkpatrick`s theory. Level 1, level 2 and level 3 evaluations are currently used – Reaction, Learning/ Knowledge, Behaviour.

(1) The immediate reaction or satisfaction evaluation is designed to cover in a standardized manner 5 main areas of content: core content (RC&RC courses), personal development, professional development, content provided by National Societies, and third-party content. A 5-items questionnaire was set up in the LMS and duplicated to cover these 5 “domains”, allowing comparisons but as well quick overview on the cumulative results of each of the area.

(2) Scored results evaluations (learning/ knowledge, level 2) were as well set up for several courses, allowing course owners to track progress by measuring learning acquisitions against the initial level.

(3) Not least, the impact evaluation tool available in the LMS (behaviour, level 3) was very helpful to easily design specific questionnaires and a reminder triggered 3 months after each learner`s course completion time.

The primary use of the results translates into a closer monitoring of the training provided, allowing us the design of a system of realistic indicators to be used for efficient quality assurance. As an example, a recent condition was included into the course`s lifecycle management process: if a given course has a learners` satisfaction average (collected from the first question of the satisfaction questionnaire) of less than the global average minus 0.5, then the course should be retired from the platform; equally, if a course is performing with 0.5 better than the general average, than the technical and pedagogical methods used for the development of the course should be considered as examples for future developments of learning objects.

Equally important, learning reports were set up on the platform for each course, capturing the results of level 1 and level 3. These customised reports are shared with relevant stakeholders, which have access to real-time data and feedback from learners. The evaluation results are mainly used by the course owners to periodically review their courses in terms of validity, accuracy, relevance.

Three data sources were used for the evaluation report data presented in the following pages:

- **participation**/ interest – registrations, completions and time spent in training;
- **satisfaction**/ immediate feedback – captured at completion of each course through an end-of-course questionnaire; in total, more than 72,000 responses were provided; the question used for this analysis was:
    - *Do you feel you are now better able to apply these specific skills and knowledge in your professional area?*
- **impact**/ behaviour – captured 3 months after completion of each course through a self-activating impact questionnaire, with more than 5,000 responses provided in 2015; the questions in focus were:
    - *Overall, do you feel that what you learned in this course was helpful for your professional work in this area?*

- *To what extent has this course enabled you to play a more supportive and constructive role in contributing to the organisation where you work?*

3 Progress and Added Value

The results of the evaluative investigation relies on data gathered from more than 72,000 respondents to satisfaction questionnaire, meaning almost 350 responses for each course on average, and over 5,000 respondents to impact evaluation questionnaire.

Organisation of the results is following the current structure of the catalogue of online course, i.e.:

1. Training Packs, Set 1: **Red Cross and Red Crescent –** (1.1) Essential Courses; (1.2) Volunteering; (1.3) National Society Development; (1.4) Disaster Management; (1.5) Health.
2. Training Packs, Set 2: **Personal Development –** (2.1) Knowing Myself; (2.2) Communication Skills; (2.3) Situation Awareness & Diversity; (2.4) Health and Well-being; (2.5) Time and Information Management; (2.6) Team Management; (2.7) Leadership & Decision Making.
3. Training Packs, Set 3: **Professional Development -** (3.1) Education and Training; (3.2) HR; (3.3) Logistics/ Purchasing; (3.4) PMER – planning, monitoring, evaluation, reporting.

3.1 Red Cross and Red Crescent Areas of Focus

The courses in RC&RC domain are addressing specific knowledge, developing skills, and promoting specific professional values at the core of humanitarian work undertaken by volunteers and staff in Red Cross and Red Crescent:

- know, believe in, and act according to RCRC principles, values, standards and mission;
- understand the humanitarian context; understand key stakeholders and contextual practices affecting current and future humanitarian interventions; underlie causes of the humanitarian crisis;
- maintain ethical and professional behaviour in accordance with the relevant RCRC codes of conduct; challenge decisions and behaviour which breach the International Red Cross and Red Crescent` Code of Conduct;
- be prepared to provide services ranging from disaster relief and assistance for the victims of war, to first aid training and restoring family links;
- operate safely and securely in high risk environments; reduce vulnerability by complying with safety and security protocols set by the organisation and adapt them to the local context;
- participate in the design and implementation of effective humanitarian projects and programmes;
- contribute to policies and decisions and acting in line with the adopted decisions and recommendations.

More than 90% of the learners – out of the total of 63,946 participating to the survey after completing at least a course in this section – report that, as a result of taking the course, they are now better able to apply the targeted specific skills and knowledge in their professional area.

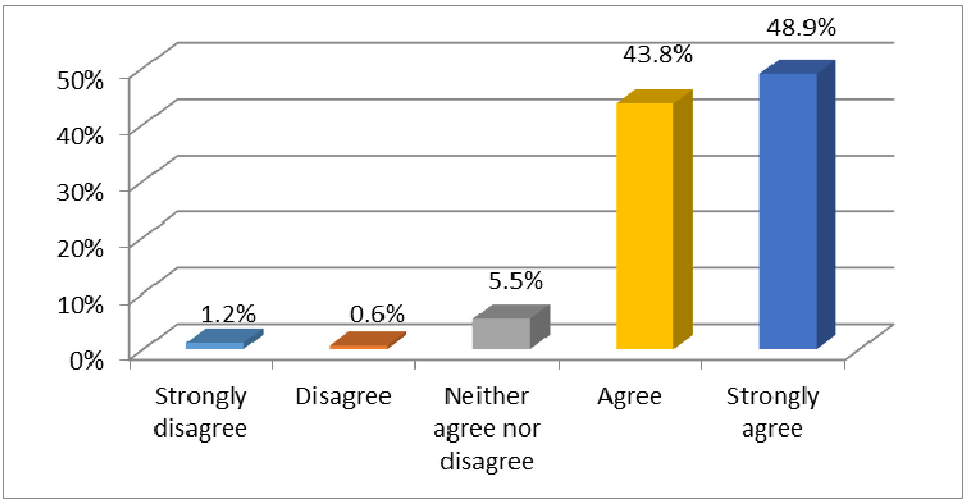

Fig.1. *Learners completing a RCRC course are better prepared in their professional area (%; N=63,946; total for 60 courses in RCRC training set)*

3.1.1 Essential Courses

Currently, there are 11 courses falling under ”The Essentials” in Red Cross & Red Crescent – launched between 2009 and 2015 – with a total of 273,264 registrations and 142,058 completions up to date; the completion rate is 52%.

Considering only the group of volunteers taking these courses, there are more than 155,000 registrations and 84,000 completions, with a slightly higher commitment measured by the rate of completion (54.4%).

Table 1. *RCRC Essential courses: total number of registrations and completions by RC/RC volunteers*

Title of the course	**Reg #**	**Compl #**	**Compl %**
The World of Red Cross and Red Crescent (WORC)	24,310	11,547	47.5%
Strategy 2020	18,709	12,873	68.8%
Volunteering - Basic Course	30,432	20,597	67.7%
Stay Safe – Personal Security	25,412	16,224	63.8%
Code of Conduct	6,610	2,001	30.3%
101: Corruption Prevention *(just launched, only English version available)*	144	39	27.1%
102: Corruption Prevention for Managers – an Introduction *(just launched, only English version available)*	34	4	
Project/ Programme Planning (PPP)	11,746	3,560	30.3%
Introduction to Monitoring and Evaluation	932	132	14.2%
Stay Safe – Security Management	8,246	3,899	47.3%
How can we keep our information safe?	110	49	44.5%
Total	**155,802**	**84,760**	**54.4%**

On the RCRC Learning platform, an online course qualifies to appear under “The Essentials” topic if it meets all the three criteria established by the Learning platform team:

(1) It has a broad audience. It addresses a majority of “Volunteers” and/or “Staff”.

(2) a. The content covers an induction topic, necessary for Red Cross Red Crescent newcomers to get a good understanding of the fundamentals of RCRC Movement. *OR*

b. The content addresses an important RCRC subject, required for a knowledgeable performance, a committed behaviour and/or a professional attitude of volunteers and/or staff. *OR*

c. The course content covers the most prominent and important part of one of the existing RCRC LP topics – volunteering, national societies development, disaster management, (global) health, development, humanitarian diplomacy etc. – being a "representative" course for a specific (main) line of action within the RCRC Movement.

(3) The course meets standard pedagogical and technical requirements.

Courses such as "The World of Red Cross and Red Crescent (WORC)", "Strategy 2020", "Volunteering – Basic Course", "Stay Safe" series, and "Code of Conduct" were the headline of the Red Cross and Red Crescent induction and generic training offer for many years, supporting staff and volunteers to start or to refresh their knowledge and skills.

As a result of taking these courses, almost 94% of the participants declared they are now better prepared to apply in their area of work the acquired skills and knowledge.

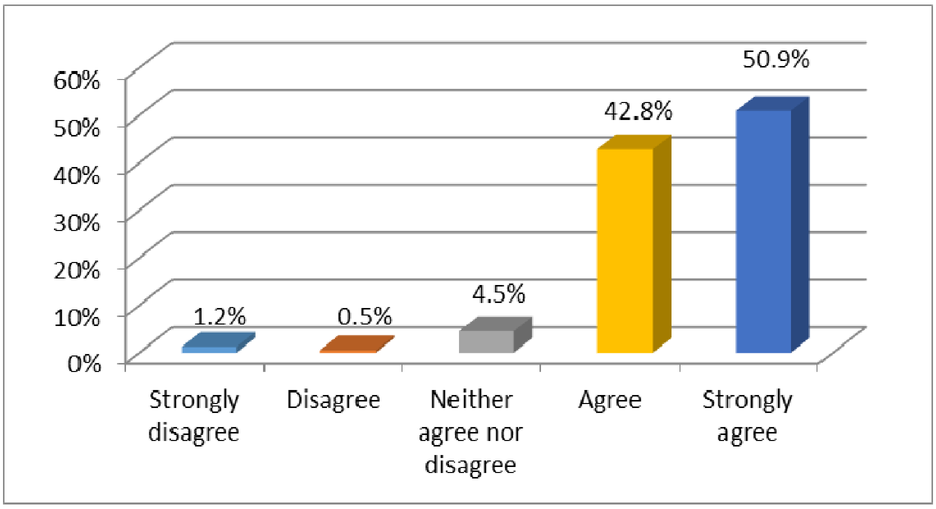

Fig.2. *Learners completing a course in RCRC Essentials section feel they are better prepared in their professional area (%; N=39,437; total for 11 courses)*

Three months after completion, the learners still report that what they learned was helpful for your professional work in this area, to a large extent (52%) and to a very large extent (37%) – these being the highest ratings compared to the other groups of courses.

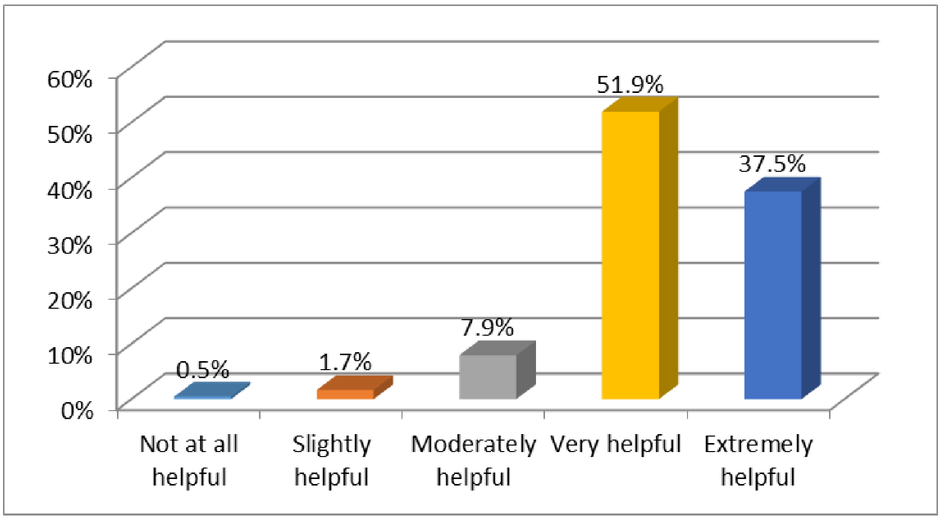

Fig.3. *Courses in RCRC Essentials section were helpful for participants (%; N=1977; 11 courses; 3 mo. after completion)*

Furthermore, they acknowledge that the course(s) enabled them to play a more supportive and constructive role in contributing to the organisation where they are working. Considering all the feedback received regarding the selection of 11 courses in RCRC Essentials, taking into account only the groups of volunteers and staff in National Societies, we have more than 80% recording a significant support, three months after completion.

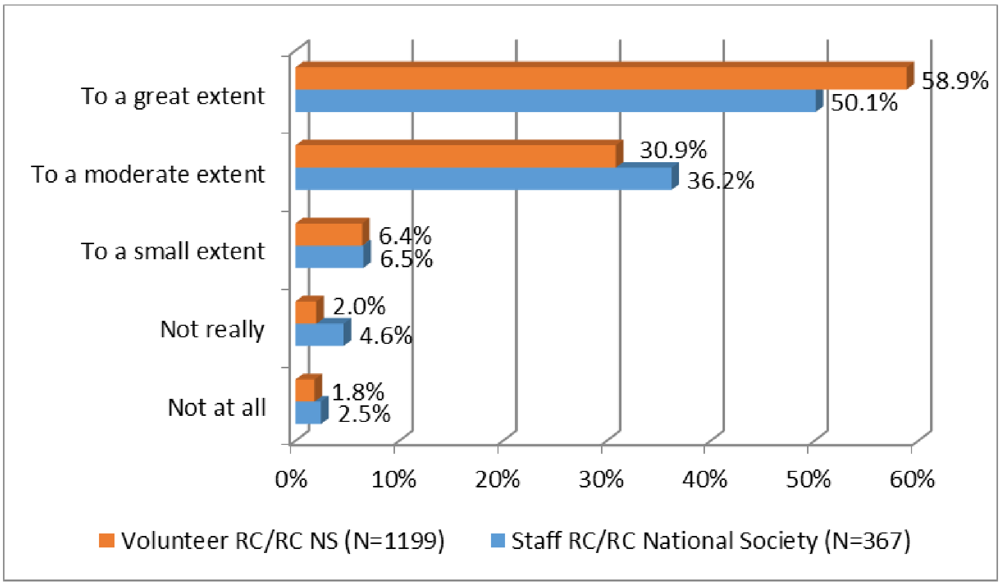

Fig.4. *Volunteers and staff in National Societies completing an Essential course note its contribution to their role in the organisation (11 courses, 3 mo. after completion)*

3.1.2 Volunteering

The highest so far, the volunteers` average completion rate is 57.3% to the 4 courses and 1 curriculum in Red Cross and Red Crescent Volunteering section on the online learning platform:

- Volunteering Red Cross and Red Crescent Induction Course (59% completion rate)
- Volunteering - Basic Course (68%)
- Stay Safe - Volunteer Security (33%)
- Volunteering – Branch Leadership Development (35%)
- Essentials in Leadership for RCRC Decision-Makers, Volunteers, Youth and Staff – *curriculum* (20%)

The outcomes are related to several core knowledge, skills and values which are part of the competency portfolio of RCRC volunteers and staff:

- demonstrate humanitarian values and principles, and motivate others to understand and act according to them;
- demonstrate understanding of your role and that of your organisation and of other stakeholders within the humanitarian system;
- reduce vulnerability by complying with safety and security protocols set by the organisation and adapt them to the local context; keep the safety of colleagues and team members in mind at all times.

At completion, a very high percentage (94%) of the learners taking courses in this section declare they are better able to apply these specific skills and knowledge in their professional area.

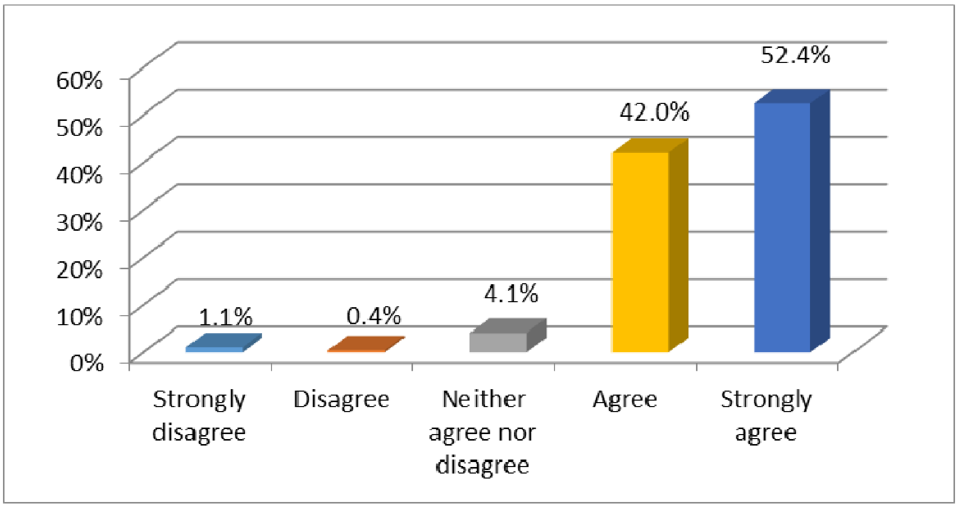

Fig.5. *Learners completing a course in Volunteering feel they are better prepared in their professional area (%; N=19,704; total for 5 courses)*

The extent to which these courses were indeed helpful for their professional work is again measured three months after completion, and the results are now taking into account the perspective of their concrete working experience.

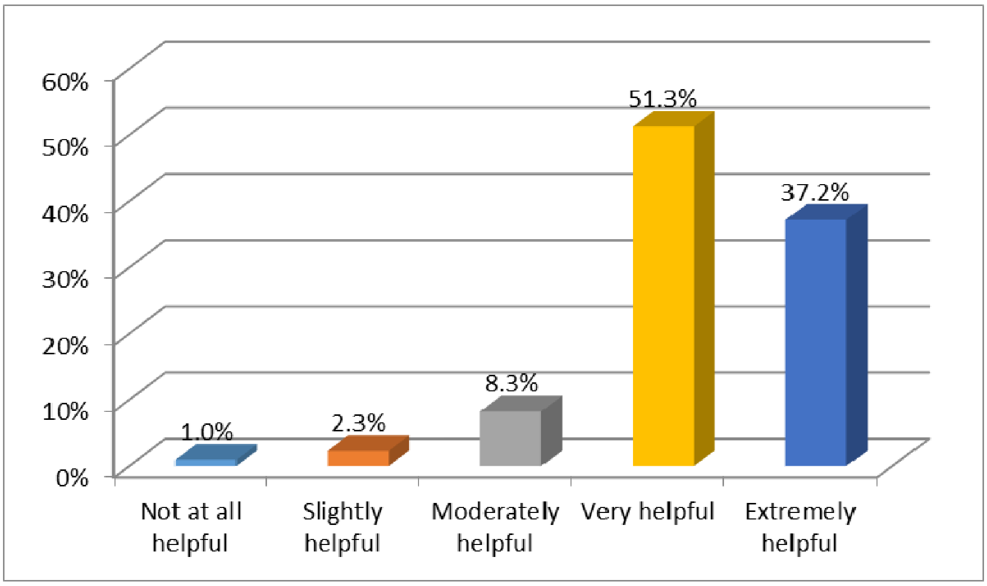

Fig.6. *Courses in RCRC Volunteering were helpful for participants (%; N=1059; 5 courses; 3 mo. after completion)*

Volunteers and staff in RC/RC National Societies declare these course enabled them to play a more supportive and constructive role in contributing to the organisation.

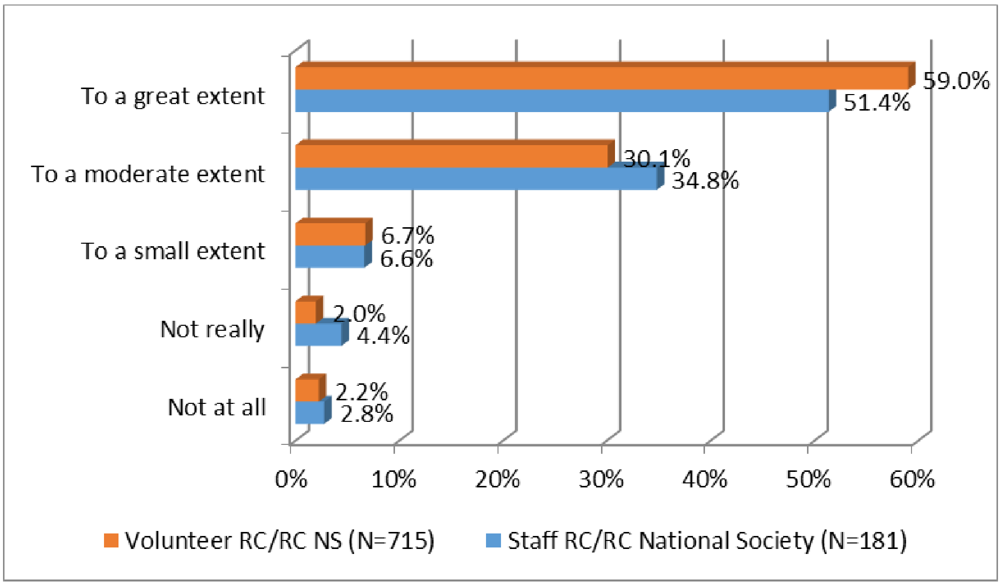

Fig.7. *Volunteers and staff in NS completing a Volunteering course note its contribution to their role in the organisation (5 courses, 3 mo. after completion)*

3.1.3 National Society Development

Dedicated rather to staff in National Societies, the courses in NSD category have been developed by IFRC, ICRC or both, between 2011 and 2015:

- Introduction to National Society Development
- Introduction to Governance for Red Cross and Red Crescent Leadership
- Introduction to Governance and Management
- National Societies Statute Revision
- Red Cross Red Crescent Movement Partnerships
- Understanding Statutory Contributions (2 modules)

The courses are aiming to help learners:

- to ensure that programme goals, activities and staff behaviour uphold key national and international humanitarian frameworks, standards, principles and codes to which the organisation has committed;
- to develop and maintain collaborative and coordinated institutional relationships;
- to participate in the development of an organisational response based on an understanding of the operating context;
- to participate in disaster coordination and interagency cooperation, based on a clear understanding of own organisation's perspective and approach.

Convergent with the intentions, learners finalising a National Society Development course agree to a significant extent that it helped them to be better able to cope with challenges in their daily work.

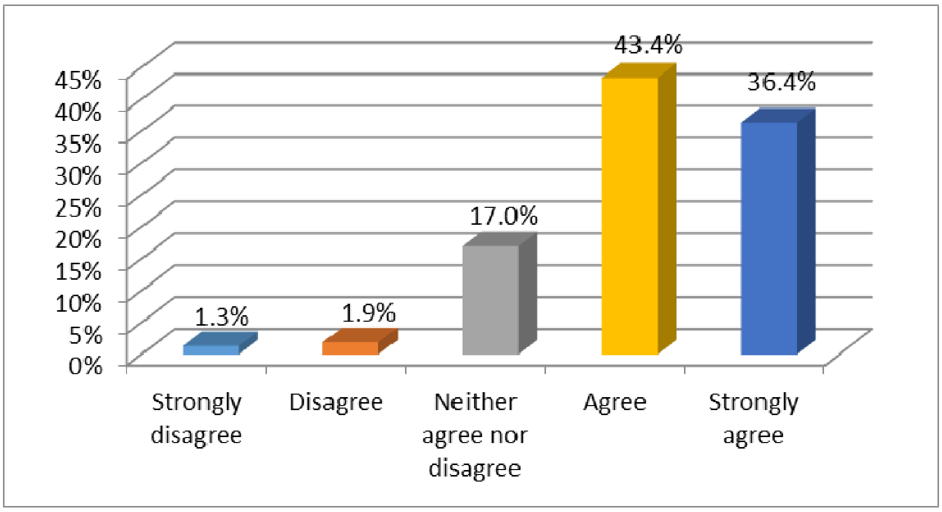

Fig.8. *Learners completing a course in NSD section feel they are better prepared in their professional area (%; N=525; total for 6 courses)*

To date, volunteers are counting 646 completions to courses in this section (35% of the registrations), spending on average 38 minutes within a course, and staff in National Societies 466 completions (35%), with a significantly higher time in training mean of 75 minutes.

3.1.4 Disaster Management

The Disaster Management section comprises 21 courses such as: *"IDRL - Introduction to International Disaster Response Laws, Rules and Principles"*, *"Principles and Rules for RCRC*

Humanitarian Assistance", "103: Preventing Corruption in Humanitarian Aid", "Contingency Planning", "Emergency Needs Assessment", "The ABC of VCA", "Cash Transfer Programming", "Basics of Livelihoods", "Restoring Family Links & Psychosocial Support".

These courses are focused on helping RC&RC volunteers and staff to:

- understand the phases of humanitarian response, including preparedness and contingency, disaster risk reduction, response and recovery;
- develop contingency plans;
- assess and analyse key issues in the humanitarian situation and formulate actions to respond to them; identify, assess and communicate risk and threats, and act to mitigate them;
- collect, analyse and disseminate relevant and useful information and feedback with crisis-affected people and other stakeholders; assess the needs, skills, capacities and experience of crisis-affected people and consider these in the response;
- take measures to '*do no harm*' and to minimise risks for your partners and the crisis-affected people you work with;
- adapt plans quickly to respond to emerging situations and changing environments;
- ensure efficient and transparent use of resources in accordance with internal controls.

In total, volunteers count over 17,000 registrations and 6,611 completions, with an average time in training of over 200 minutes per course. The most requested courses by volunteers were "*IDRL - Introduction to International Disaster Response Laws, Rules and Principles*" (5237 registrations, 47% completion rate), "*Sphere Handbook in Action*" (3902 registrations, 21% completion rate), and "*Climate Change – An Introduction for Staff and Volunteers*" (1372 registrations, 52% completion rate).

Staff of RC/RC National Societies attended mostly the online courses "*IDRL - Introduction to International Disaster Response Laws, Rules and Principles*" (1734 registrations, 45% completion rate) and "*Introduction to Cash Transfer Programming*" (1200 registrations, 43% completion rate).

At completion, the degree of learners` satisfaction regarding the achievements shows that these courses were well received and helpful, 90% of them saying they are better prepared.

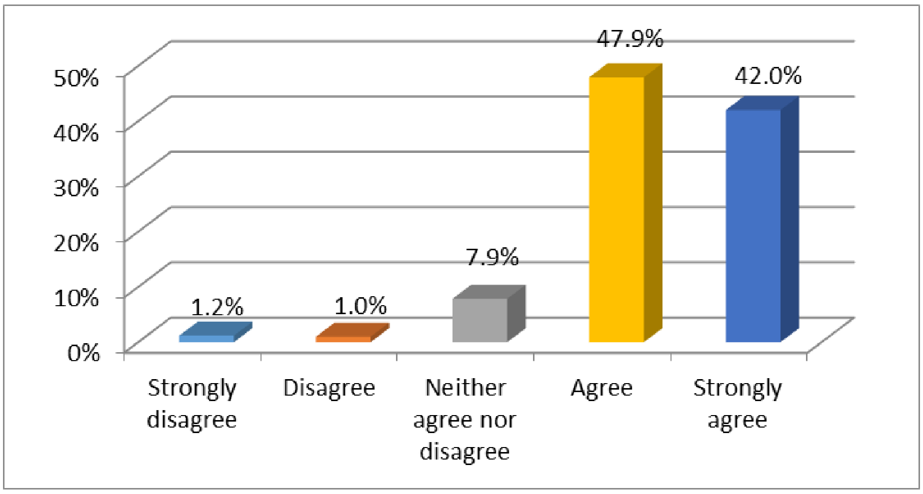

Fig.9. *Learners completing a course in Disaster management feel they are better prepared in their professional area (%; N=7,663; total for 21 courses)*

Similarly, three months after completion, learners still feel that what they learned had an added-value for their professional work.

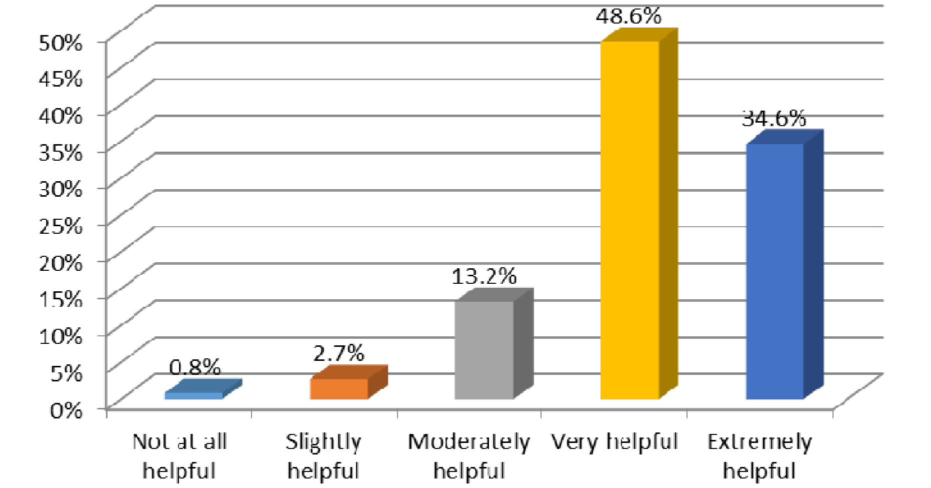

Fig.10. *Courses in Disaster management were helpful for participants (%; N=589; 21 courses; 3 mo. after completion)*

The added value is as well reported by our main target groups, volunteers and staff in RC/RC, disaster management courses being perceived as contributing to a great extent in playing a more supportive and constructive role in the organisation.

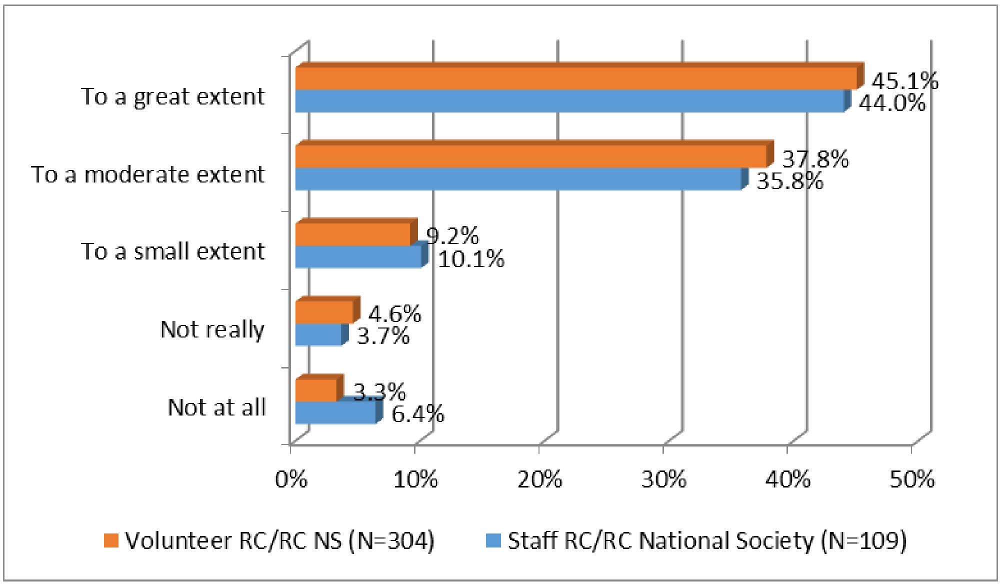

Fig.11. *Volunteers and staff in NS completing a course in Disaster management note its contribution to their role in the organisation (24 courses, 3 mo. after completion)*

3.1.5 Health

With a continuously growing number of courses, Health section approaches today several main themes:

- Community-Based Health and First Aid (CBHFA) – 4 modules
- Public Health in Emergencies – 6 modules
- Ebola Awareness
- Influenza pandemic preparedness
- H2P - Humanitarian Pandemic Preparedness Programme
- LIFESAVER: Interactive CPR *(external training)*

The group of RC/RC volunteers on the Learning platform spent on average 100 minutes per course. The total number of volunteers registrations is 16,662 and the completion rate is 53%. By far, the most requested course was "*Ebola Awareness*", with 2020 registrations and 75% completion rate since its launch on September 2014, followed by "*Community-Based Health and First Aid (CBHFA)*" with a total of 9058 registrations to any of the 4 modules and 57% completion rate counted since the launch in 2012.

For this section, almost 3,000 completions out of 5,900 registrations are added together by staff (50% completion rate), and the average time in each course was 115 minutes. They were interested in "*CBHFA", Module 1: Introduction, Module 2: Volunteer Action*, and *Module 3: Facilitation* (2,735 registrations and over 60% completion rate), and "*H2P - Humanitarian Pandemic Preparedness Programme*" (563 registrations and 40% completion rate).

Confidence in the usefulness of the achievements is declared by all participants, as they agree to a large extent they are better able to fulfil their role in humanitarian aid, as a result of taking these courses.

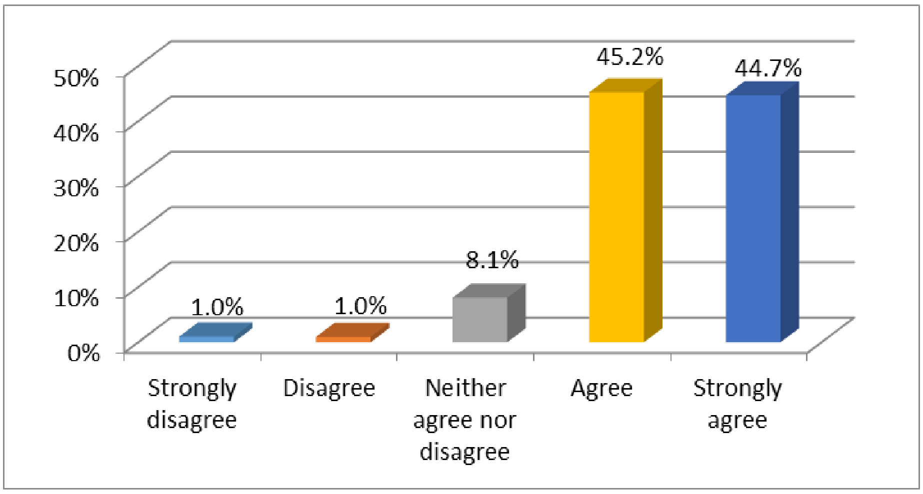

Fig.12. *Learners completing a course in Health feel they are better prepared in their professional area (%; N=9,519; total for 16 courses)*

Three months after finalising the courses, the confidence is (most of the times) supported by evidences – what they learned was helpful for their professional work, for almost 100%.

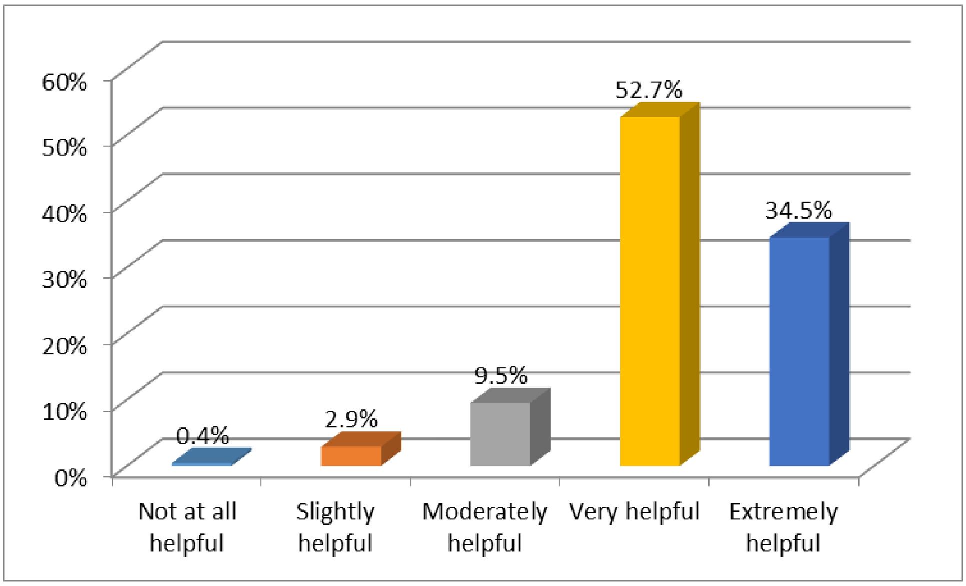

Fig.13. *Courses in Health were helpful for participants (%; N=693; 16 courses; 3 mo. after completion)*

Volunteers are much more inclined to judge the short online courses in Health as very useful for their role – 57%, compared to 40% of staff – understandable, considering their access to this kind of specialised courses.

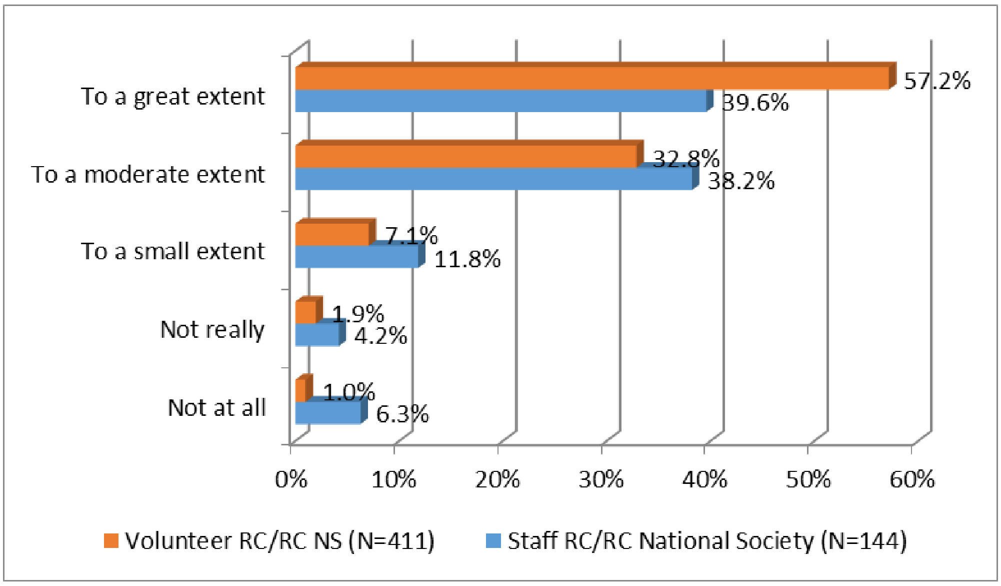

Fig.14. *Volunteers and staff in NS completing a course in Health note its contribution to their role in the organisation (16 courses, 3 mo. after completion)*

3.2 Personal Development

The courses in Personal development section are related to interpersonal competencies such as teamwork, collaboration, communication, relationship building, influencing, resilience, adaptability, initiative. Overall, they are very well received, extensively covering a general need to expand the knowledge horizon and to perform better in professional as well as in everyday life.

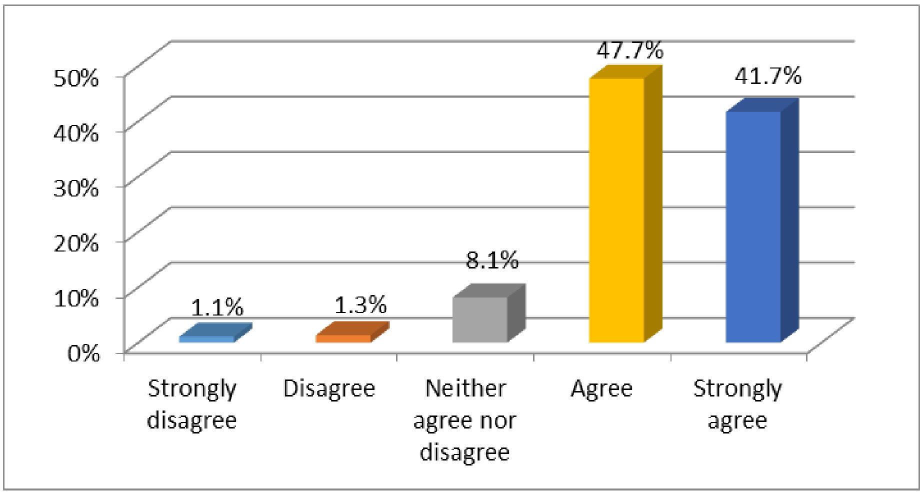

Fig.15. *Learners completing a Personal development course are better prepared in their professional area (%; N=4,526; total for 62 courses in this training set)*

A number of 62 courses are distributed in 7 categories, all being almost equally rated by the learners who took them in the last couple of years. On a 1-5 scale, the courses score 4.28 on average. The only selections of courses assessed higher by the staff comparing to volunteers are "Team management" and "Leadership".

Table 2. *Learners` ratings for personal development courses*

Section (& no. of courses comprised)	**RC/RC Volunteers**	**Staff RC/RC NS**	***All learners***	***Total no of respondents***
1. Knowing Myself (11)	4.36	4.15	*4.31*	*1187*
2. Communication skills (7)	4.34	4.28	*4.30*	*616*
3. Situation Awareness & Diversity (5)	4.32	4.23	*4.28*	*447*
4. Health and Well-being (3)	4.48	4.43	*4.44*	*230*
5. Time and Information Management (6)	4.29	4.18	*4.24*	*430*
6. Team Management (13)	4.27	4.32	*4.28*	*949*
7. Leadership & Decision Making (17)	4.14	4.16	*4.16*	*667*
TOTAL (62 courses in Personal development)	**4.30** (3,022 respondents)	**4.23** (1,084 respondents)	***4.28***	***4,526***

The added-value is also higher for volunteers, as reported three months after completion. Even though these are general courses, the usefulness is as high as of the courses in Red Cross and Red Crescent section.

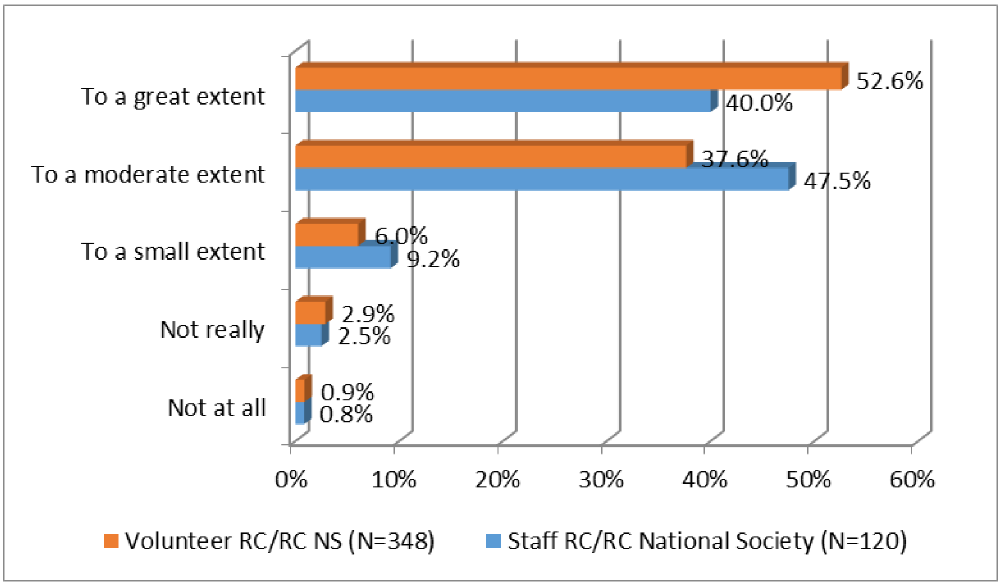

Fig.16. *Volunteers and staff in NS completing a course for personal development note its contribution to their role in the organisation (62 courses, 3 mo. after completion)*

3.2.1 Knowing Myself

Eleven courses are forming this dedicated section, contributing to volunteers and staff` competencies development by training them:

- to be aware of own strengths and limitations and their impact on others; to demonstrate flexibility to adapt in situations of rapid change;
- to manage themselves in a pressured and changing environment; to be aware of internal and external influences that affect their performance.

A clear preference was noticed for the course "*Assertiveness: know your profile*", available on the platform in English, French, Spanish, Italian, Portuguese, and Brazilian-Portuguese, to which more than 1700 volunteers and staff registered in the last 4 years since it was made available on the platform.

In total, the section Knowing Myself has 4,638 registrations and 1,754 completions from volunteers and staff.

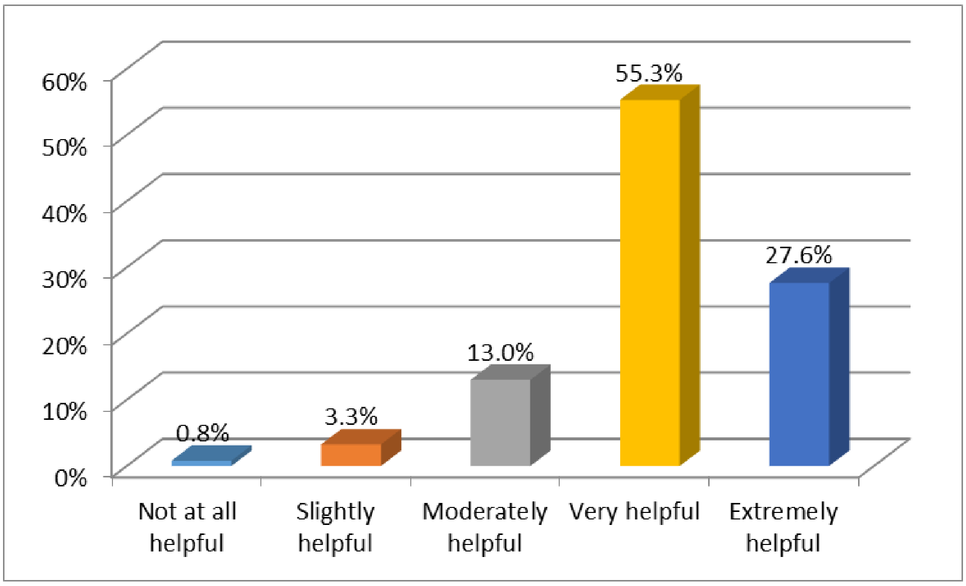

Fig.17. *Courses in "Knowing myself" section were helpful for participants (%; N=123; 11 courses; 3 mo. after completion)*

3.2.2 Communication Skills

The communication courses are aiming to empower participants:

- to seek practical ways to overcome barriers in communication;
- to establish and maintain clear dialogue with crisis-affected people or other stakeholders;
- to influence others positively to achieve goals.

The courses in this category were used by a number of 2,143 volunteers and staff, the most interesting being "*Non-verbal communication and Synergology*", a 30 minutes course available in English, French, Spanish, Chinese, Portuguese, and Dutch, which gathered 500 registrations with a 50% completion rate, followed by "*How to write an effective e-mail*", with 400 registrations and the same rate of completion.

3.2.3 Situation Awareness & Diversity

The Situation awareness and diversity section is aiming to empower learners to:

- analyse and exercise judgment in challenging situations; assess the needs, skills, capacities and experience of crisis-affected people and apply these in the response; adapt calmly to changing situations and constraints
- operate safely and securely in a pressured environment
- understand diversity dimensions of humanitarian situations; actively listen to new and different perspectives and experiences of crisis-affected people, stakeholders and team members; work effectively with people from all backgrounds; act in non-discriminatory way

Out of the 6 courses offered – gathering in total 3,581 registrations and 1,172 completions by volunteers and staff – the top most wanted titles were:

- "Gender equality in programme planning - Different needs, equal opportunities": 2379 registrations
- "Improving communication by adapting to others": 617 registrations

- “3 essential levers for building a winning co-operation”: 337 registrations

3.2.4 Health and Well-being

The training offer in this sub-domain is comprising three courses, until now:

- *Staying healthy*
- *Understand how you deal with stress*
- *Handling stress*

They target behaviours and competencies useful when working is humanitarian assistance, such as:

- adapt calmly to changing situations and constraints;
- remain constructive and positive under stress to be able to tolerate difficult and challenging environments;
- recognise personal stress and take steps to reduce it.

RC/RC volunteers and staff reached a completion rate of 52% to these courses – with 577 registrations and 302 completions to date – with the fastest growing interest, after *Knowing Myself* section.

3.2.5 Time and Information Management

Two courses from this section seem to be the most interesting for RC&RC volunteers and staff: “*Increasing your productivity in a fast-paced world*” (with 462 registrations to date) and “*Focusing on your priorities*” (415 registrations). In total, the 6 courses presented gathered 1,567 enrolments and 602 completions, being focused on development of several necessary general abilities:

- achieving results effectively, considering the need for prompt response, scale and quality;
- remaining focused on your objectives and goals in a rapidly changing environment;
- delivering timely and appropriate results using available resources.

3.2.6 Team Management

The Team Management section is comprised of a selection of 13 courses covering pretty well the knowledge domain and, moreover, the associated skills:

- ensure that projects` goals, activities and staff behaviour uphold key frameworks, standards, principles and codes;
- demonstrate an understanding of coordination mechanisms;
- demonstrate understanding of when a decision can be taken and when to involve others.

From the volunteers and staff group, 3,556 registrations and almost 1,300 completions were recorded to the courses in this category, more than one third of them being counted under “*Fostering and maintaining motivation*” (1,384 registrations), a 30 minutes online course available in 12 languages.

Participants are considering the time spent in learning as a good investment in their development, and the achievements useful for their professional work.

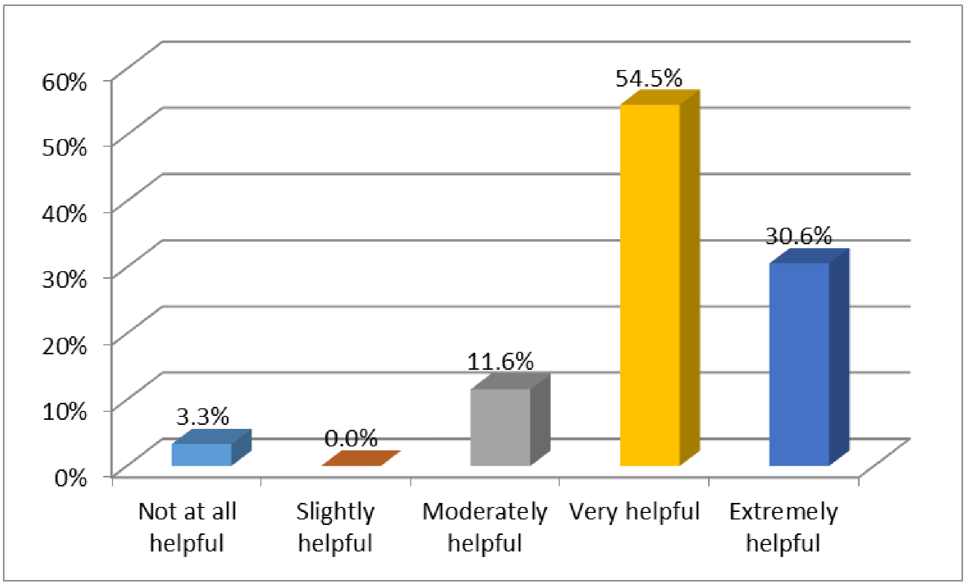

Fig.18. *Courses in "Team management" were helpful for participants (%; N=121; 13 courses; 3 mo. after completion)*

3.2.7 Leadership & Decision Making

With an offer of 17 courses, this section is the largest Personal development area addressed by the Learning platform, being therefore consistent with the needs for personal and professional progress nowadays, covering:

- achieving results effectively, considering the need for speed, scale and quality;
- encourage others to share authentic/ humanitarian values;
- act decisively and adapt plans quickly to respond to emerging situations and changing environments;
- consider the wider impact of own decisions in order to achieve results;
- be answerable to crisis-affected people for own actions and decisions;
- use own power responsibly, in line with accountability principles and standards.

The 2,936 registrations are quite evenly distributed to all 17 courses. Staff in RC/RC National Societies is valuing them more than the group of volunteers. Three months after completion, the courses in this section are considered by the participants as being more useful than the courses in any other personal development area.

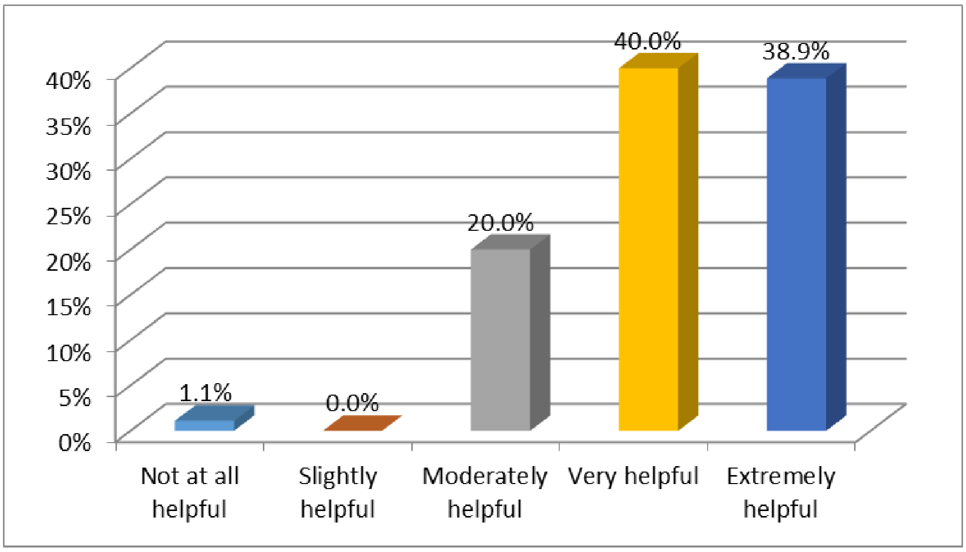

Fig.19. *Leadership courses were helpful for participants (%; N=90; 17 courses; 3 mo. after completion)*

3.3 Professional Development

For the moment, the entire Professional development section is comprised of 25 courses, distributed in 4 professional domains:

- Education and Training
- HR
- Logistics/ Purchasing
- PMER (planning, monitoring, evaluation, reporting)

The number of completions and registrations by RC&RC volunteers and staff is as well indicating a big interest, considering courses` narrow addressability:

Table 3. *Learners` participation in professional development courses*

Section (& no. of courses comprised)	Registration #	Completion #	Completion %	Av. time in training (min.)
1. Education and Training (5)	1,634	609	41.4%	104
2. HR (4)	262	107	38.2%	58
3. Logistics/ Purchasing (12)	793	270	42.3%	85
4. PMER (4)	1,446	415	30.1%	76
TOTAL (25 courses in Professional dev.)	**4,180**	**1,423**	**33.4%**	47

On a 1-5 scale, the courses score 4.20 on average.

Table 4. *Learners` ratings for professional development courses, by audience groups*

Section (& no. of courses comprised)	**RC/RC Volunteers**	**Staff RC/RC NS**	***All learners***	***Total no of respondents***
1. Education and Training (5)	4.33	4.25	*4.29*	*530*
2. HR (4)	4.48	4.29	*4.38*	*108*
3. Logistics/ Purchasing (12)	4.06	3.99	*4.02*	*222*
4. PMER (4)	4.12	4.10	*4.12*	*352*
TOTAL (25 courses in Professional dev.)	**4.24** (737 respondents)	**4.15** (361 respondents)	***4.20***	***1212***

Trying to have an insight regarding the benefits brought in, 3 months after completion the learners have been asked if what they learned in the course was helpful for their professional work.

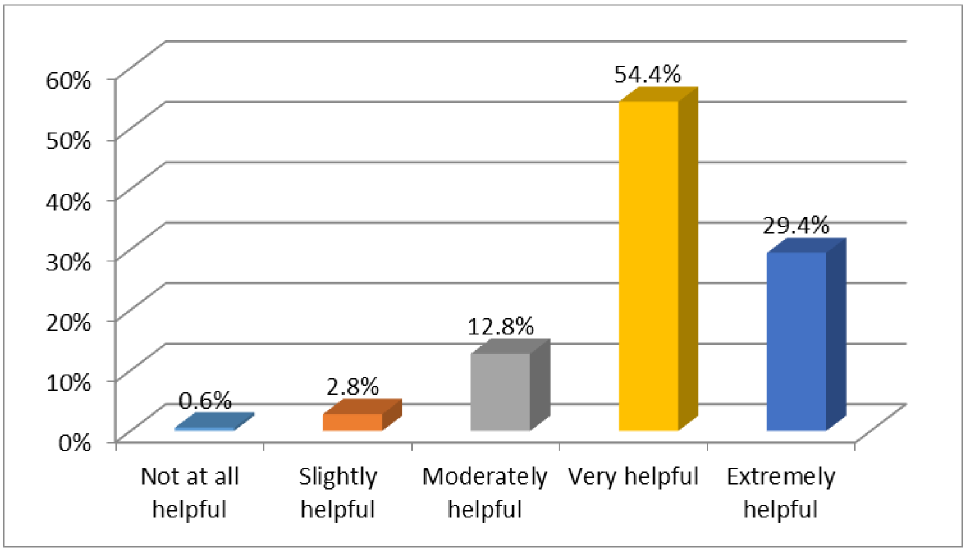

Fig.20. *Courses in "Professional development" training set were helpful for participants (%; N=180; 25 courses; 3 mo. after completion)*

Again, more than 80% considered the acquired skills and knowledge as being very profitable and helping them to fulfil their role.

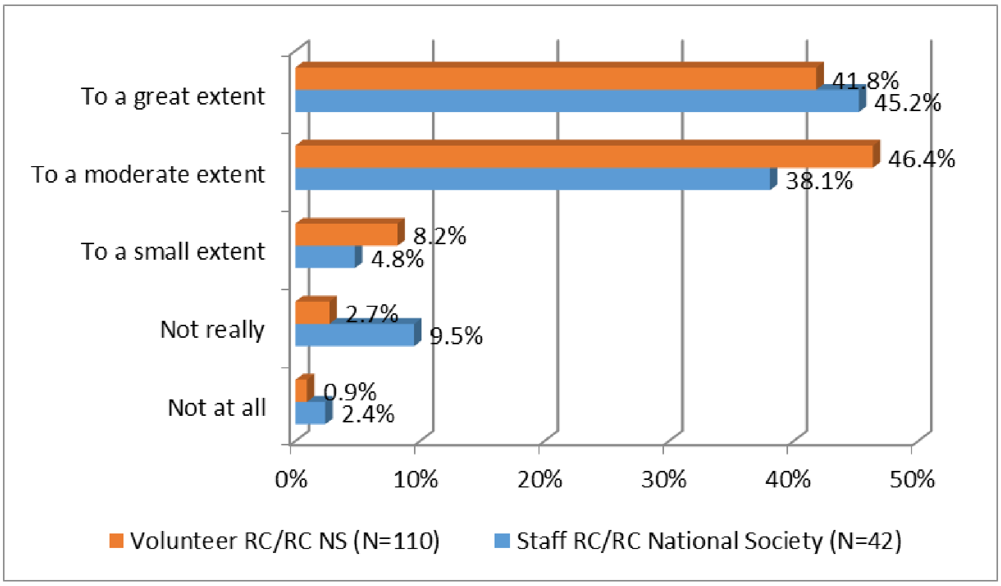

Fig.21. *Volunteers and staff in NS completing a course in "Prof. development" note its contribution to their role in the organisation (25 courses, 3 mo. after completion)*

4 Conclusions and Recommendations

"Learning organisation" is not a new concept any more, it is a mandatory condition for functioning as an institution in the 21st Century, regardless the domain and the type of business.

4.1 Fowards Organisational Learning

A perturbing assertion regarding learning culture in humanitarian organisations, provided in a recent report, puts pressure on assessing to what extent the services provided meet current standards, and innovation, competitiveness, development are continuously assumed and reinforced by staff: *"There is a frightening lack of institutional learning in humanitarian agencies. Rapid staff turnover, low investment in training and little focus on knowledge management as a driving force for the organization mean that experience rests in the heads of a few long-term staff or in dusty filing cabinets. Few systems for institutional learning seem to be functional. Development here is critical if agencies are to remain innovative and able to balance local nuances against global standards."* (Peter Walker, 2004 - "What Does it Mean to Be a Professional Humanitarian?").

A number of questions could bring more clarity to the mandate of developing a framework for a continuous learning needs analysis and consequently a tailored learning strategy. Embedding (more) learning into current processes builds upon a determined *status quo*. Whilst not exhaustive, several key-questions could encompass primarily two perspectives supporting a learning culture, inclusive and exclusive, complemented with two axes, individual and organisational:

Set 1

How the humanitarians currently acquire their knowledge and competencies?

Are there any specific continuous professional development programmes for professionals and/or for volunteers in humanitarian aid?

To what extent these could/ should be standardised and who should be in charge with the standardisation?

Set 2

Are the RCRC Movement components innovative and competitive enough?

To what extent the IFRC and/or the members of the RCRC Movement are authentic learning organisations?

What are the current mechanisms, channels, and drivers for organisational (inter-)learning?

To what extent a Learning strategy would fit into the current policies, strategies, institutional goals? Is it needed at institutional level (IFRC, National Societies), at Movement level, at leadership level, at individual level? Should it be set up to bridge an already identified gap, to support more efficiency, to drive innovation?

Learning and development is critical to the organisation`s ability to execute on strategy. But far from being easy targets, empowering people to perform as authentic professionals and setting up the collective mind-set underpinning a learning organisation is a **holistic, a trans-departmental approach** and a **strategic goal**. It is a fluid and continuous innovation process, involving all resources and targeting changes at all levels, affecting sometimes fundamental organisational structures. Therefore, readiness for change should as well be correctly estimated and firstly addressed as a pivot variable when planning.

A recent paper on the changing context of a “professional humanitarian” evokes ethics, good management, holistic approach and inclusion, and authentic values as the core of the approach to organisational change in humanitarian institutions (Walker, 2014). Furthermore, one can easily argue that humanitarianism cannot be maintained and developed without building strong general and specific competencies to core-professional humanitarians and as well to the volunteers.

A model of professionalism for RCRC organisations would have four pillars, against which (institutional) performance could be assessed:

- values, knowledge and systems – i.e. a series of underpinning values such as humanity/ solidarity, independence, impartiality a.s.o., supported by an underlying basic body of scientific knowledge, and by systems to apply this knowledge (Schien, 1973, apud Walker, 2014)
- awareness of the extent to which these exist in the person and in the organisation of practitioners, taking as well into account the changing environment
- a research and training system which provides an ever-learning foundation for the practitioners, complemented with appropriate mechanisms for “embodied inter-learning”
- a dynamic and respectful relationship with the beneficiaries.

To what extent the professionals (staff but as well volunteers) in the RCRC Movement are performing within this framework and, moreover, to what extent the organisation is supporting them to excel in their duties – these are open questions to circumscribe the further work towards establishing a learning strategy. In other words, there is definitely a need to reveal, develop or empower the linkage between the learning systems in place and the learning processes with added value for RCRC staff and volunteers.

4.2 Learning as Duty and Opportunity

From an institutional perspective, learning is key to organisational health and competitiveness. Guy, Beaman and Weinstein (2005) affirm – or rather confirm – that the century is moving forward at a rapid pace: people are becoming more technologically advanced, have higher expectations, are open to globalization and growing, being more innovative with each passing day. Therefore, organizational strategies are less anchored in current activities (and their current operating contexts) and very much concerned with the future, the unknown, thinking of and learning how to do things differently, performing things differently and supporting changes. Organizations that have integrated their human resource management polices with the organisational strategies (and the strategic change process, including training, and employee relations) manage their change successfully (Armstrong, 2006). The functions of learning support teams and HR staff are not any more tagged as administrative – they started to be seen as providing expertise in how to leverage the human capital, and consequently the value of the institution and services it is providing, in the end ensuring the existence of the institution, as the main change agents, able to facilitate any major project, and especially the "sensitive" ones or the ones with a high degree of novelty, by having a significant impact on involved employees (Caldwell, 2003).

For individuals, taking a course is most of the times just a new beginning – the start in exploring new information, developing new competencies, and undertaking new roles. Learning is inextricably linked with work – activity, practice, application, innovation in a field of knowledge (regardless if monetarized, monetized, or non-monetized) – growing together and supporting each other, the double helix of human DNA (Giarini& Malitza, 2003). Our personal, professional, cultural, economic, social life is continuously reaching new levels and tending to fulfilment by trying to determine our place and duties as human beings, as parts of interconnected groups and communities, contributing in various ways to their development, being *humanitarians* not only in crisis but in everyday life.

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Interval-Valued Neutrosophic Oversets, Neutrosophic Undersets, and Neutrosophic Offsets

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Abstract

We have proposed since 1995 the existence of degrees of membership of an element with respect to a neutrosophic set to also be partially or totally above 1 (over-membership), and partially or totally below 0 (under-membership) in order to better describe our world problems{[1]-[4], 2007}.

Keywords: interval neutrosophic overset, interval neutrosophic underset, interval neutrosophic offset, interval neutrosophicoverlogic, interval neutrosophicunderlogic, interval neutrosophicofflogic, interval neutrosophicoverprobability, interval neutrosophicunderprobability, interval neutrosophicoffprobability, interval overmembership (interval membership degree partially or totally above 1), interval undermembership (interval membership degree partially or totally below 0), interval offmembership (interval membership degree off the interval [0, 1]).

AMS Mathematics Subject Classification (2010): 03E72, 94D05

1. Introduction

"*Neutrosophic*" means based on three components *T (truth-membership)*, *I (indeterminacy)*, and *F (falsehood-nonmembership)*. And "over" means above 1, "under" means below 0, while "offset" means behind/beside the set on both sides of the interval [0, 1], over and under, more and less, supra and below, out of, off the set. Similarly, for "offlogic", "offmeasure", "offprobability", "offstatistics" etc.

It is like a pot with boiling liquid, on a gas stove, when the liquid swells up and leaks out of pot. The pot (the interval [0, 1]) can no longer contain all liquid (i.e., all neutrosophic truth / indeterminate / falsehood values), and therefore some of them fall out of the pot (i.e., one gets neutrosophic truth / indeterminate / falsehood values which are > 1), or the pot cracks on the bottom and the liquid pours down (i.e., one gets neutrosophic truth / indeterminate / falsehood values which are < 0).

Mathematically, they mean getting values off the interval [0, 1].

The American aphorism "think outside the box" has a perfect resonance to the neutrosophic offset, where the box is the interval [0, 1], yet values outside of this interval are permitted.

2. Example of MembershipAbove 1 andMembership Below 0

Let's consider a spy agency $S = \{S_1, S_2, \ldots, S_{1000}\}$ of a country Atara against its enemy country Batara. Each agent S_j, $j \in \{1, 2, \ldots, 1000\}$, was required last week to accomplish 5 missions, which represent the full-time contribution/membership.

Last week agent S_{27} has successfully accomplished his 5 missions, so his membership was $T(A_{27}) = 5/5 = 1 = 100\%$ (full-time membership).

Agent S_{32} has accomplished only 3 missions, so his membership is $T(S_{32}) = 3/5 = 0.6 = 60\%$ (part-time membership).

Agent S_{41} was absent, without pay, due to his health problems; thus $T(S_{41}) = 0/5 = 0 = 0\%$ (null-membership).

Agent S_{53} has successfully accomplished his 5 required missions, plus an extra mission of another agent that was absent due to sickness, therefore $T(S_{53}) = (5+1)/5 = 6/5 = 1.2 > 1$ (therefore, he has membership above 1, called over-membership).

Yet, agent S_{75} is a double-agent, and he leaks highly confidential information about country Atara to the enemy country Batara, while simultaneously providing misleading information to the country Atara about the enemy country Batara. Therefore S_{75} is a negative agent with respect to his country Atara, since he produces damage to Atara, he was estimated to having intentionally done wrongly all his 5 missions, in addition of compromising a mission of another agent of country Atara, thus his membership $T(S_{75}) = -(5+1)/5 = -6/5 = -1.2 < 0$ (therefore, he has a membership below 0, called under-membership).

3. Definition of Interval-ValuedNeutrosophicOverset

Let U be a universe of discourse and the neutrosophic set $A_1 \subset U$.
Let T(x), I(x), F(x) be the functions that describe the degrees of membership, indeterminate-membership, and nonmembership respectively, of a generic element $x \in U$, with respect to the neutrosophic set A_1:

$T(x), I(x), F(x) : U \rightarrow P([0, \Omega])$,

where $0 < 1 < \Omega$, and Ω is called overlimit,

$T(x), I(x), F(x) \subseteq [0, \Omega]$, and $P([0, \Omega])$ is the set of all subsets of $[0, \Omega]$.

An Interval-Valued Neutrosophic Overset$A_1$is defined as:
$A_1 = \{(x, <T(x), I(x), F(x)>), x \in U\}$,
such that there exists at least one element in A_1 that has at least one neutrosophic component that is partially or totally above 1, and no element has neutrosophic components that is partially or totally below 0.
For example: $A_1 = \{(x_1, <(1, 1.4], 0.1, 0.2>), (x_2, <0.2, [0.9, 1.1], 0.2>)\}$, since $T(x_1) = (1, 1.4]$ is totally above 1, $I(x_2) = [0.9, 1.1]$ is partially above 1, and no neutrosophic component is partially or totally below 0.

4. Definition of Interval-ValuedNeutrosophicUnderset

Let U be a universe of discourse and the neutrosophic set $A_2 \subset U$.
Let T(x), I(x), F(x) be the functions that describe the degrees of membership, indeterminate-membership, and nonmembership respectively, of a generic element $x \in U$, with respect to the neutrosophic set A_2:

$T(x), I(x), F(x) : U \rightarrow [\Psi, 1]$,

where $\Psi < 0 < 1$, and Ψ is called underlimit,

$T(x), I(x), F(x) \subseteq [\Psi, 1]$, and $P([\Psi, 1])$ is the set of all subsets of $[\Psi, 1]$.

An Interval-Valued Neutrosophic Underset$A_2$is defined as:
$A_2 = \{(x, <T(x), I(x), F(x)>), x \in U\}$,

such that there exists at least one element in A_2 that has at least one neutrosophic component that is partially or totally below 0, and no element has neutrosophic components that are partially or totally above 1.
For example: $A_2 = \{(x_1, <(-0.5,-0.4), 0.6, 0.3>), (x_2, <0.2, 0.5, [-0.2, 0.2]>)\}$, since $T(x_1) = (-0.5, -0.4)$ is totally below 0, $F(x_2) = [-0.2, 0.2]$ is partially below 0, and no neutrosophic component is partially or totally above 1.

5. Definition of Interval-ValuedNeutrosophicOffset

Let U be a universe of discourse and the neutrosophic set $A_3 \subset U$.
Let T(x), I(x), F(x) be the functions that describe the degrees of membership, indeterminate-membership, and nonmembership respectively, of a generic element $x \in U$, with respect to the set A_3:
$T(x), I(x), F(x) : U \rightarrow P([\Psi, \Omega])$,
where $\Psi < 0 < 1 < \Omega$, and Ψ is called underlimit, while Ω is called overlimit,
$T(x), I(x), F(x) \subseteq [\Psi, \Omega]$, and $P([\Psi, \Omega])$ is the set of all subsets of $[\Psi, \Omega]$.
An Interval-Valued Neutrosophic Offset$A_3$is defined as:
$A_3 = \{(x, <T(x), I(x), F(x)>), x \in U\}$,
such that there exist some elements in A_3 that have at least one neutrosophic component that is partially or totally above 1, and at least another neutrosophic component that is partially or totally below 0.
For examples: $A_3 = \{(x_1, <[1.1, 1.2], 0.4, 0.1>), (x_2, <0.2, 0.3, (-0.7, -0.3)>)\}$, since $T(x_1) = [1.1, 1.2]$ that is totally above 1, and $F(x_2) = (-0.7, -0.3)$ that is totally below 0.
Also $B_3 = \{(a, <0.3, [-0.1, 0.1], [1.05, 1.10]>)\}$, since $I(a) = [-0.1, 0.1]$that is partially below 0, and $F(a) = [1.05, 1.10]$ that is totally above 1.

6. Interval-ValuedNeutrosophicOverset / Underset / OffsetOperators

Let U be a universe of discourse and $A = \{(x, <T_A(x), I_A(x), F_A(x)>), x \in U\}$
and $B = \{(x, <T_B(x), I_B(x), F_B(x)>), x \in U\}$ be two interval-valued neutrosophic oversets / undersets / offsets.
$T_A(x), I_A(x), F_A(x), T_B(x), I_B(x), F_B(x): U \rightarrow P([\Psi, \Omega])$,
where$P([\Psi, \Omega])$ means the set of all subsets of $[\Psi, \Omega]$,
and $T_A(x), I_A(x), F_A(x), T_B(x), I_B(x), F_B(x) \subseteq [\Psi, \Omega]$,
with $\Psi \leq 0 < 1 \leq \Omega$, and Ψ is called underlimit, while Ω is called overlimit.
We take the inequality sign $\leq$ instead of $<$ on both extremes above, in order to comprise all three cases: overset {when $\Psi = 0$, and $1 < \Omega$}, underset {when $\Psi < 0$, and $1 = \Omega$}, and offset {when $\Psi < 0$, and $1 < \Omega$}.

6.1. Interval-ValuedNeutrosophicOverset / Underset / Offset Union

Then $A \cup B =$
$\{(x, <[\max\{\inf(T_A(x)), \inf(T_B(x))\}, \max\{\sup(T_A(x)), \sup(T_B(x))\}],$
$[\min\{\inf(I_A(x)), \inf(I_B(x))\}, \min\{\sup(I_A(x)), \sup(I_B(x))\}],$
$[\min\{\inf(F_A(x)), \inf(F_B(x))\}, \min\{\sup(F_A(x)), \sup(F_B(x))\}]>, x \in U\}$.

6.2. Interval-ValuedNeutrosophicOverset / Underset / Offset Intersection

Then $A \cap B =$

$\{(x, <[\min\{\inf(T_A(x)), \inf(T_B(x))\}, \min\{\sup(T_A(x)), \sup(T_B(x)\}],$
$[\max\{\inf(I_A(x)), \inf(I_B(x))\}, \max\{\sup(I_A(x)), \sup(I_B(x)\}],$
$[\max\{\inf(F_A(x)), \inf(F_B(x))\}, \max\{\sup(F_A(x)), \sup(F_B(x)\}]>, x \in U\}.$

6.3. Interval-ValuedNeutrosophicOverset / Underset / Offset Complement

The complement of the neutrosophic set A is

$C(A) = \{(x, <F_A(x),[\Psi + \Omega - \sup\{I_A(x)\}, \Psi + \Omega - \inf\{I_A(x)\}], T_A(x)>), x \in U\}.$

Conclusion

After designing the neutrosophic operators for single-valued neutrosophic overset/underset/offset, we extended them to interval-valued neutrosophic overset/underset/offset operators. We also presented another example of membership above 1 and membership below 0.

Of course, in many real world problems the neutrosophic union, neutrosophic intersection, and neutrosophic complement for interval-valued neutrosophic overset/underset/offset can be used. Future research will be focused on practical applications.

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Developing a Dynamic Interface for a Heritage Management Application in Educational Platforms

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Abstract

This article describes the development of a web interface of an application for archaeological management system (RM360) used in online education platforms for archeology, architecture and restoration. Being a heritage management application, the database is populated with the related historical, cultural and archaeological items (elements). The application is part of the "Adopt a House in Roşia Montană" program, initiated in June 2012 by the local association Albumus Maior, in partnership with ARA Association (Architecture.Restoration. Archaeology). The program aims at saving the cultural heritage of the historic site in Roşia Montană (Alba County, Romania). The historic site of Roşia Montană was recently proposed for the indicative list of UNESCO World Heritage, thus the importance and relevance of the current application being urgently topical.

Keywords: Web Interface, Design, Software Tools, Advanced Web Technologies

1 Introduction

The present application is part of the "Adopt a House in Roşia Montană" program (adoptaocasa.ro), aimed at saving the cultural heritage of Roşia Montană and neighboring villages (Rădescu and Tudor, 2014; Rădescu and Ismail, 2014; Rădescu and Ismail, 2015; Rădescu and Olaru, 2015).

The application enables viewing and editing of complex archaeological objectives of users with a hierarchical access. According to this hierarchical access, the application contains three major components:

- The administrator interface;
- The supervisor/expert interface;
- The user/guest interface.

The dynamic nature of the interface developed is given by web technologies used for searching and displaying results in real time, popular pages based on elements that exist in the database at query time. Also the applicaton can allow entering, removing or editing items through affordable pages of restricted categories of users.

2 Software Tools and Technologies

The interface is developed in Microsoft Visual Studio 2012 development environment. It was chosen because it allows sharing tools and creating solutions using multiple programming languages. For proper development of the interface, we used a collection of technologies which help to deliver a variety of information (w3schools.com/json/; dana-damoc.eu/blog/introducere-la-bootstrap-3/; developers.google.com/maps).

These technologies are: HTML5 (Hyper Text Markup Language), CSS3 (Cascading Style Sheets), Boostrap, JavaScript, jQuery, AJAX (Asynchronous JavaScript and XML) and JSON (Java Script Object Notation). The graphic design of components is solved using Adobe Photoshop (CS6 graphics editing environment) and the map section is designed using Google Maps API.

3 Designing the Application

The RM360 application is part of an archaeological management system, so it was useful to introduce hierarchical user access. Given this hierarchy, the operating principle of the application is relatively simple: when accessed the application will open the main page that contains some information about it and a contact form that can connect with the people managing the application (administrators).

This page contains links to the page corresponding to objectives entered in the program and to the login page. After logging in, according to the account permission, users are redirected to the section dedicated to administrator or supervisor/expert. It aims to reach the page devoted to each objective and, on this page, the records management.

The administrator has full rights to the application, can make any change, read posts and manage user accounts (granting permission). The supervisor is the expert (architect, archaeologist) helping administrator, having the same rights, less accounts management.

4 Design and Implementation of the User/Guest Interface

This section is available to all users who access the application and wish to obtain information about the "Adopt a House in Roşia Montană" program and the heritage items within.

The design of this interface is developed so that navigation is performed in a simple and intuitive manner as it is designed for visitors who only have access to view the information provided on the application and contact the administrator through filling in the Contact section form. The entire interface is developed in HTML and structurally each page has the following composition:

```
@{
ViewBag.Title = "Home";
}
@{
Layout = null;
}
<html>
<head>
<meta charset="utf-8">
<!-- Css Files-->
@Styles.Render("~/Content/themes/sitecss/css")
<!-- Script Files -->
@Scripts.Render("~/bundles/sitescripts")
<!-- GoogleMaps Script -->
<script type="text/javascript"
src="http://maps.google.com/maps/api/js?sensor=false"></script>
<title> Home </title>
</head>
<body>
/* divs to construct and separate sections */
</body>
</html>
```

The top is not part of the actual structure of an HTML document, but serves as a liaison with the server. "Layout = null;" indicates that there is a model (a template), on which it builds pages.

The <html> tag is used to inform the browser about the format of the page that will be opened. The <Head> section is intended to introduce the necessary page loading scripts, style files, and script required to load Google Maps API. It also specified the type of text encoding, UTF-8 in this case, because it is the most common format, supporting special characters for multiple languages. The <title> tag it is introduced as the page that will appear in the CPC browser (URL) to refresh the page. The <Body> tag contains the main part of the page, which mainly includes several <div> tags that are designed to divide the page. Within these tags formatting is (not) allowed, depending on the design requirement.

The Home of the app is the page user faces when accessing the application. This has been designed in back-end (Pupezescu, 2012; Pupezescu, 2015a; Pupezescu, 2015b; Pupezescu, 2015c). The design of this page is based on a developed model already existing on site, offered free (bootstrapzero.com), which we edited according to application requirements with CSS3 styling and by deleting or adding Boostrap classes.

The page contains a small carousel with images of Roşia Montană (mixdecultura.ro/2013/09/; turismrosia.wordpress.com/poze-rosia-montana/), a menu bar and a footer with links that redirect to the official website of the "Adopt a House in Roşia Montană" program (adoptaocasa.ro) and to the Facebook page thereof (see Figure 1).

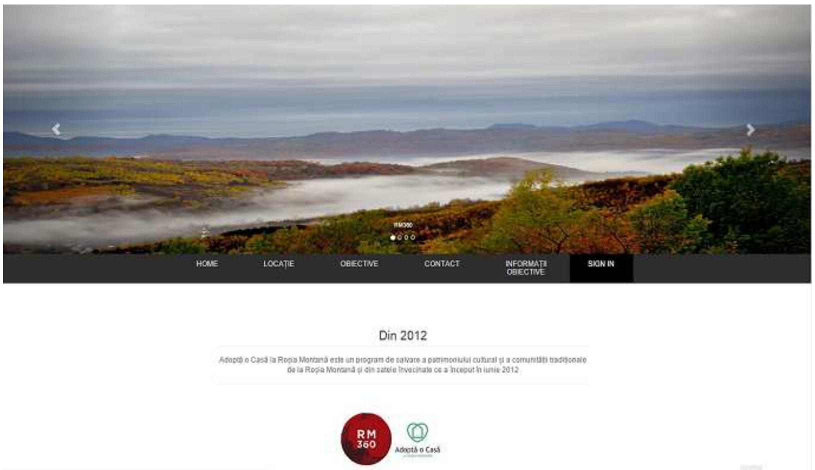

Figure 1. The Starting Interface (Home Page)

Carousel site and menu bar are implemented using Boostrap classes and were styled by creating our own classes to get the design according to application requirements. We created footer as defined by the "footer" CSS class. This class is used for all pages in this section. It contains statements about the size, color and type writing in order to provide web-responsive features.

Tabs are generated through “li”s, as a list, each having an ID to be identified.

```
<li class="lead"><a href="#section1">Home</a></li>
<div class="divider" id="section1"></div>
```

We entered the class lead properties by editing font and color. Each tab we added has a black hover when the mouse is used to indicate position (on mouse-over).

```
.navbar-custom .navbar-nav li>a:hover, .navbar-nav li .open, .navbar-custom .navbar-nav
.active a {
background-color: #000; // background color
height: 68px; // width
}
```

Home section provides information about the "Adopt a House in Roşia Montană" program, taken from the official website, program logo and RM360 application logo (simpara.ro/rosia-montana-360-expo-workshop-567.html).

In Location section we introduced a Google map which provides a satellite positioning in Roşia Montană. A starting map was necessary to be introduced in the <head> script tag section of the page to create a jQuery script, according to the official Google API documentation.

```
<script type="text/javascript"
src="http://maps.google.com/maps/api/js?sensor=false"></script>
```

The script placed in the <head> tag has two attributes: the first one specifies the type of script, and the second one specifies the path to the JavaScript file needed to upload the Google Maps API. Because the corresponding sensor is set to false value, it will not detect geo-locations. Map itself is introduced by the following jQuery script:

```
<script type="text/javascript">
$(document).ready(function () {
initialize();
});
function initialize() {
var mapOptions = {
center: new google.maps.LatLng(46.306293, 23.130430),
zoom: 16,
mapTypeId: google.maps.MapTypeId.SATELLITE
};
var map = new google.maps.Map(document.getElementById("map_canvas"),
mapOptions);
// create a marker
var latlng = new google.maps.LatLng(46.306293, 23.130430);
var marker = new google.maps.Marker({
position: latlng,
map: map,
title: 'Roşia Montană'
});
}
</script>
```

To paste, three properties of the "mapOptions" variable were initiated. Center property contains the coordinates of the location where the entry will be originated. This location is represented by a geographical point, which is a LatIng object characterized by latitude and longitude (specified in degrees).

The property tag indicates the original zoom resolution of the map. We used the "–" and "+" buttons at the left to set the map zoom level at 16, but it can be modified between 1 and 21. mapTypeID defines the use of map data and translates coordinates from screen coordinates to map coordinates (developers.google.com/maps/).

Using this information there are four ways one can display the map:

- ROADMAP – standard type of display that displays a road map;
- SATELLITE – displays satellite image;
- HYBRID – adds satellite image labels;
- TERRAIN – displays a physical map.

To create the map of the application we chose the SATELLITE display, but it can be changed by clicking on one of the buttons at the top of the map.

The objective map is created by the new operator. It creates the variable map, using the "document.getElementById ()" method that refers to the element with map_canvas ID, which is the HTML code for the map.

Inside the map initialize function creates a marker having three properties: position, map and title (see Figure 2). The first is mandatory as it indicates the location, while the other two are optional, serving to specify the map that will be loaded marking its name.

Figure 2. The Map Section

Objectives section contains the heritage items entered into the program (churches, houses, etc.). Contact section contains a form which upon completion will be sent to application administrators. Fields marked with "*" are required for sending a message, having set required property. Information targets tab redirect users to a page containing the list of objectives entered into the application.

Sign in tab is for administrator and supervisors (to access the sections dedicated to these types of users) and for new users who want to help to preserve the cultural heritage.

The Sign in (Login) page is accessed by users with application special rights. This can be accessed from both the homepage and the page dedicated to objectives (see Figure 3).

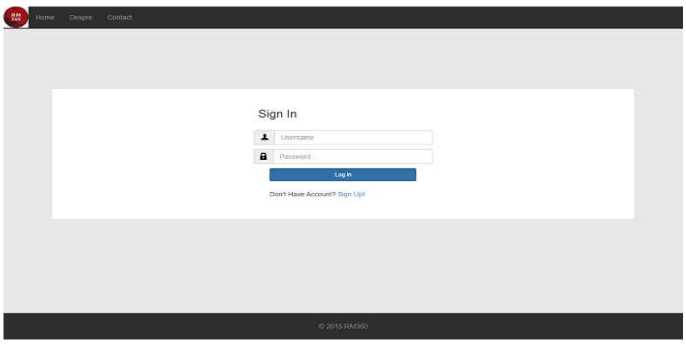

Figure 3. The Sign in Page

In terms of design there are three main elements using <div> to separate sites:

- Menu bar, where we find the application logo, the navigation links to the front page and the two modals (one to describe the application and the other for contact);
- Fields for authentication;
- Footer.

The two modals were built on standard classes (modalheader, modal-body), and the content was styled with CSS elements.

Contact Form modal fields are kind of input and placed between the <form> and </ form> tags as the data entered will be sent to a specific URL.

```
<form name="Contact" method="post"
action="@Url.Action("Contact","Home")">
```

Syntax above includes names of method to transmit data (in this case, the type is POST, because confidential information is not required) and the URL of the page that transmit information. This information is transmitted to the server after pressing Contact (this is the submit type).

The fields for authentication are part of a <form> which transmits data to "@ Url.Action" (Login, Account) via a POST method. The fields are created as input the property placeholder which is an indication of the text area. The field is password type since password for the browser may not display content inserted as text.

Submit button is designed to run form's action. For users without an account, Sign Up is the option that makes redirection to the Register Page in order to create a new user. Register follows the same template as that of the login page, having a different input.

Objective home page includes all items entered in the database. From this page, the user can access the desired objective page. The item design is depicted in Figure 4.

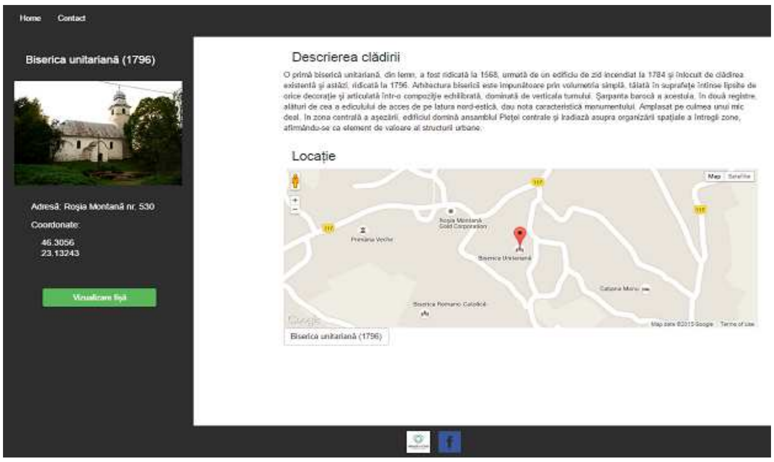

Figure 4. The Interface of the Item (Objective) Page

On the right side of the page there is some important information related to objective: name, year of construction, image, location coordinates and a button that accesses archaeological standard sheet management. The rest includes page description and a map (Google Maps API), introduced as the homepage, the only difference being that the information about latitude, longitude and objective name are dynamically updated.

Since all objectives have dedicated one page of this type, we choose to create a single HTML file, which brings information dynamically using the Razor syntax. The header page is created with edited Boostrap classes.

For low resolution devices, the right part acts as a dashboard. Thus, the header tabs and content to the right of the page are compacted in a dropdown menu. Inside this menu they appear as a list as HTML files are inserted into the <ul> tag, unordered the tag <li> tag specific lists. To achieve this dashboard, we edited existing classes for lower resolutions of 768 pixels and compacting the dropdown we used the "dropdown" and "dropdown menu" Bootstrap classes. The overflow property is auto achieved in the menu bar. Scroll down vertically by pressing the bar, the "relative" value of "position" property allows changing the initial position, thus ensuring the reliability of the Dashboard.

Figure 5. The Interface of the Item (Objective) Page for Low Resolutions

5 Conclusions

The app interface is quite useful to users of online learning systems for managing archaeological systems because we opted for intuitive design, allowing easy navigation. This design version brings new benefits to the user interface. Being at the beginning of a new development path for new deployments, further research follows:

- Implementation of interfaces for administrator and supervisor sections;
- Development of page list for objectives and records management;
- Using geo-referenced maps and appropriate representation of surfaces and contours.

The RM360 app facilitates and accelerates educational activities for training human resources involved in saving the cultural heritage of Roşia Montană. This application can be used as pilot project for expanding its use to any historical site and any heritage item.

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Virtual Library Online Services for E-books Management in Cultural and Educational Institutions

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Abstract

The described application achieved implementation of a platform for online management of an e-library, the virtual system requiring simple and efficient access in order to loan e-books. After analyzing the numerous advantages of electronic services, the aim was to implement an application that can give users access to a vast cultural and educational content, making available to them a virtual access tool to e-books from any electronic devices, including mobile or portable devices, with internet connection.

Keywords: Library Design, Database, Software Tools, Advanced Web Technologies

1 Introduction

In the time where most people regularly turn to electronic online services online, the application presented in this paper aims at simulating an electronic management system for activities of cultural and educational institutions. In practical terms, this application is designed to create virtual library services, providing different functionalities for e-administrator and e-books manager, and to facilitate quick and simple interaction with users (e-readers).

This article describes how to implement an online library (Rădescu, 2011) where anyone can borrow a book for a specified period of time. The original contributions of the paper are designing flexible database architecture, and design and development of an administration procedure that can quickly accomplish the management of information related to all items involved in a virtual library management system.

Application deployment is done in three stages: database design, development of management module for users and e-books, and development of public module for users. The database structure was designed using the MySQL database management system (Korth et al, 2010; mysql.org). The application back-end was developed in PHP, using the Laravel framework (laravel.com), and the application front-end was developed in a responsive manner using the Bootstrap framework (getbootstrap.com) and the following programming languages: JavaScript, jQuery and CSS (Ballard and Moncur, 2008). To implement the app the Sublime Text 3 (github.com) development environment was used.

After analyzing the numerous advantages of electronic services, the aim was to implement an application that can give users access to a vast cultural content. The objective of the application is to design and implementation of an online system to illustrate the electronic services offered within a virtual library through a web site.

2 Database Implementation

The database structure was designed in the MySQL language (see Figure 1). Site pages are made using Laravel's framework and the logic of events is developed in PHP code will be running in the server. To implement technology was used PHP development environment Sublime Text 3. The site is optimized for mobile devices, using a responsive theme, making it easier to upload content by adapting it to the device.

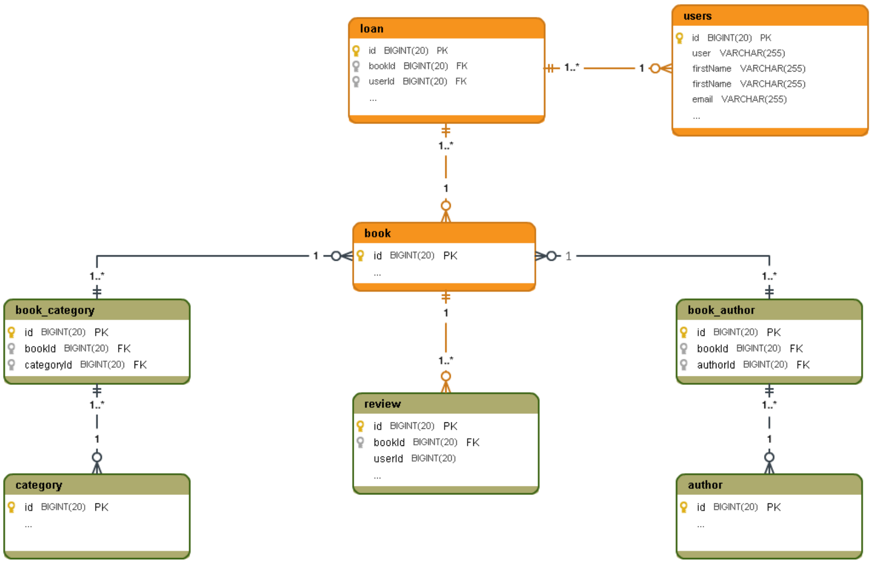


Figure 1. Database Main Diagram

Navigation is easy, regardless of device. The web interface of the application and work environment with PHP code on the server is compiled and sent back to the client, who can view the browser page received in the form of HTML. This is generated through compilation issued to the client browser. After running the application is generated the initial page Homepage, composed of elements of HTML, PHP, JavaScript and jQuery components (Levy, 2011; Pollock, 2009). PHP elements are running in the server and JavaScript elements of the jQuery libraries are running in the client browser, therefore, an Internet connection is absolutely necessary for the proper functioning of the app.

3 Registration and Authentication

The part that interacts with the user is limited to a few inputs, the user enters the login credentials. Sign up by clicking the button, the user will be redirected to the registration page. To create an account, the user must enter valid data. To ensure that the email address and password are entered correctly, they must be entered twice for validation.

After the registration was successful, the user can login name created. Sign in page functionality is similar to Sign up. Interacting with the user is limited to two textbox sites for e-mail and password, the user enters his login information. Like the Sign up page, there are validators that verify data consistency. In case of error, the message "Enter valid and current user name / password" will be displayed.

4 The Administrator Account

In the implementation of the application, there are two types of accounts: the client and the administrator. When a user is authenticated as an administrator defined in the database, it will have access to the list of existing users at that moment in the database, management software authors, categories, publishing, books, news, messages received via the form contact cards and loans. Here appears a module called Dashboard where the latest activities, statistics and daily activity (see Figure 2).

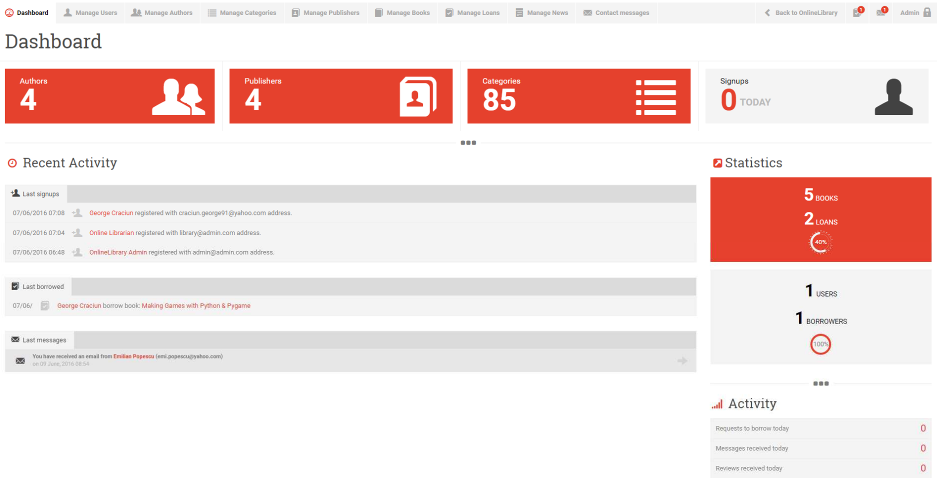
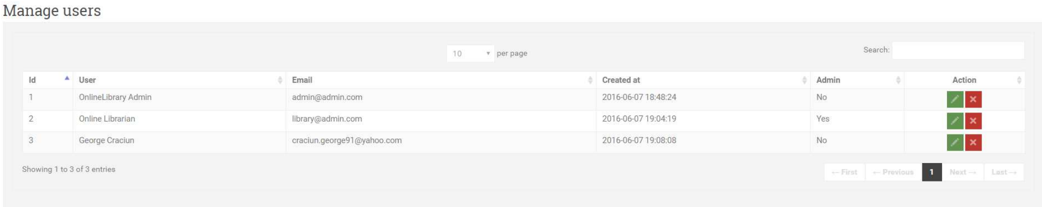


Figure 2. The Administrator Dashboard Page

The management of the users in the platform is reflected in Manage Users tab (see Figure 3). The difference between the administrator account and the librarian account is that the administrator can give users rights to the library regularly.



Manage users

Id	User	Email	Created at	Admin	Action
1	OnlineLibrary Admin	admin@admin.com	2016-06-07 18:48:24	No	
2	Online Librarian	library@admin.com	2016-06-07 19:04:19	Yes	
3	George Craciun	craciun.george91@yahoo.com	2016-06-07 19:08:08	No	

Showing 1 to 3 of 3 entries

Figure 3. Table of All Registered Users

Management of authors is made in Authors Manage tab. Actions that can be performed here are to create, read, update and delete (CRUD). For implementation the Author model was used for the communication with the database, the controller module AuhorController is responsible for module logic and listAuthor.blade.php, createAuthor.blade.php and editAuthor.blade.php views were used. Next, the authors will be assigned books. Because of the *N*:*N* connection between book and author tables in the database, a book can have multiple authors and vice versa (see Figure 4).

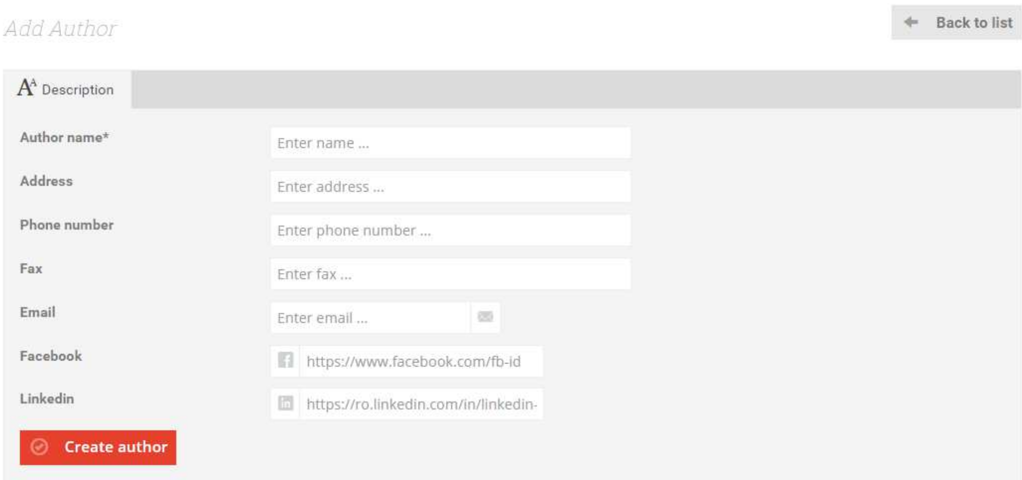


Figure 4. Form To Create an Author

Management of categories and publishers are solved similarly (see Figures 5 and 6).

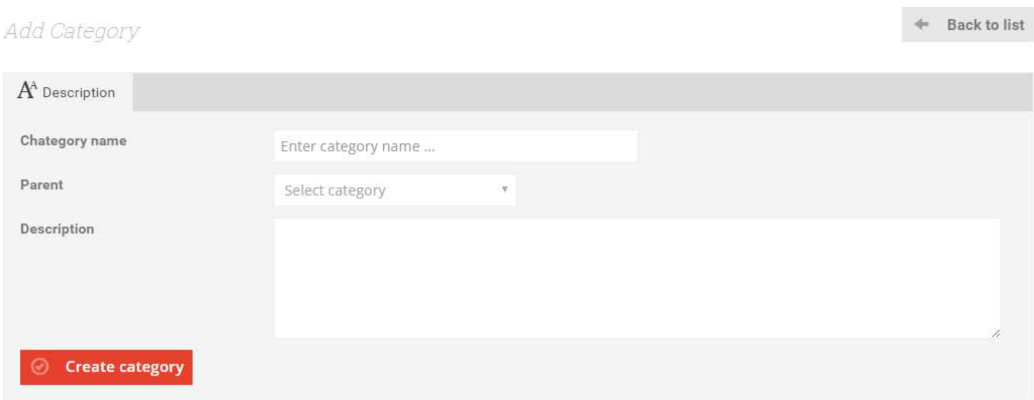


Figure 5. Form To Create a New Category

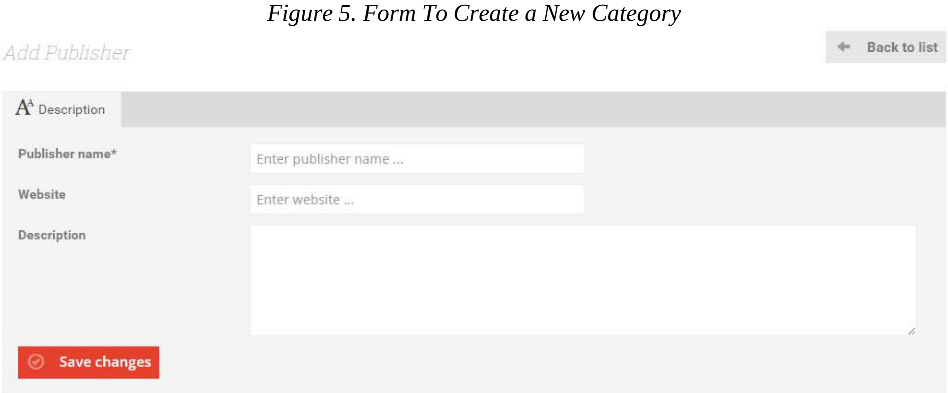


Figure 6. Form To Create a New Publisher

Categories have a tree structure. In addition the form of the class name is mandatory parent not binding because if you do not select anything means that this category is on zero. A similar procedure is used to create a publisher.

The most important is the Manage Books tab (see Figure 7). Almost all information in the platform is linked to this tab. The listing is done using an inserted card table and a plug-in for jQuery DataTools (revolution.themepunch.com). For a quick filtering, as many columns representative for finding books have been added. For example, in the title column there is the new tag where one can see if a book is published and its rating.

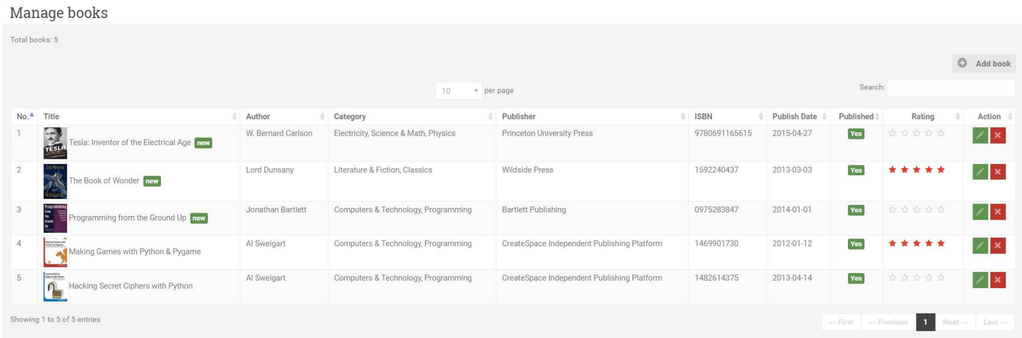


Figure 7. Table Containing All the Books in the Application

Abstract's editing uses an open source text editor based on HTML5 called wysihtml5 which is faster than other editors such as TinyMCE, Aloha, etc. This plug-in does not require jQuery, is supported by most browsers (xing.github.io). Adding PDF files and images in the platform is achieved by file type inputs, using JavaScript libraries, developed with bootstrap (jasny.net). A big advantage of the plug-in is the search the site in the select options that makes filling easier, see Figure 8 (select2.github.io).

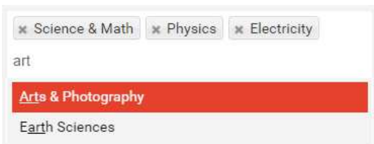


Figure 8. Multi-selection with search function

Loans Manage tab manages applications received for borrowing a book (see Figure 9). Action that can be done in this module is update. The data that make up a loan application are authenticated user, book, date on which the request was made and period in which access is sought. An application can have three statuses: pending, accepted or rejected.

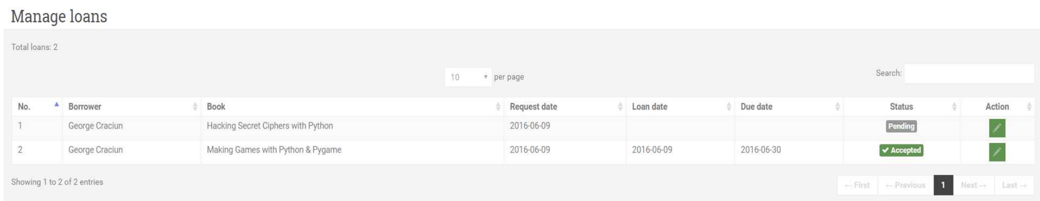


Figure 9. Table Containing All Loan Requests

To change the status each request must be edited. To provide more flexibility, administrators can modify the loan period. Each request is accompanied by the most important personal data of the user who made the request, a history of the latest books borrowed and identification data of the book.

Management of news is performed in the Manage News tab. Interface elements adding news are similar to those used for adding a book. Fields used are those found in news sites, intending to inform readers of the latest news in the specific interest areas.

5 The Client Account

When a user authenticates as a customer defined in the database, it will have access to the list of books that made the loan application. There is a module called Dashboard where users can learn the latest activities and statistics (see Figure 10).

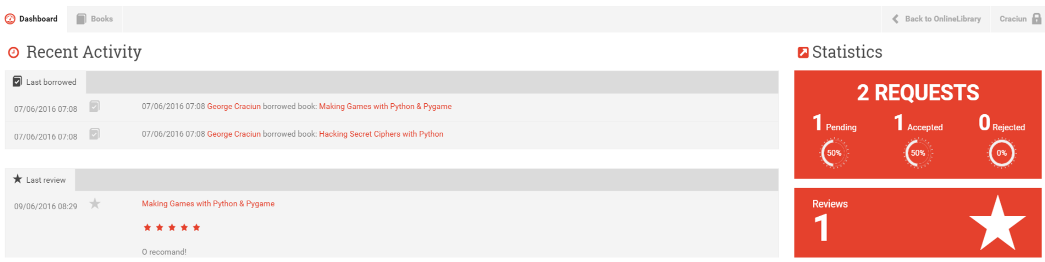


Figure 10. The Dashboard User Page

The Books tab lists all loan applications. Action that can be done in this way is the only view, if an application is accepted. Listing applications interface is similar to the Manage Loans administrator panel module, the difference being that here the customer has three types of action buttons but only the Read button is active (see Figure 11).

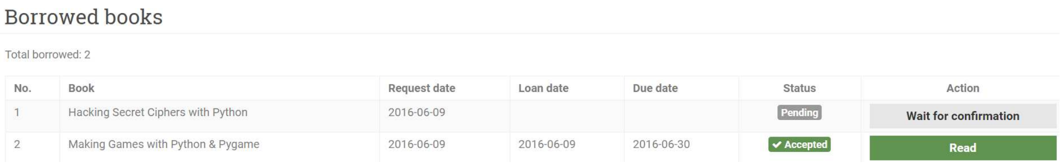


Figure 11. List of All Book Loan Requests for a Specific User

The Read button will be redirected to the readBook.blade.php view, where users can read the book in PDF format, but they will not be able to download it. This required for importing an open-source JavaScript plug-in called PDF Object that allows embedding PDF files into HTML documents (pdfobject.com). To display the content a container for storing PDFs is created and the user is informed about the uploaded PDF document. To display the toolbar the parameter is set to 0, because there is also the download button.

6 The Public Interface

The public interface, available to both logged-in and not logged-in users, is divided into three general pages: Home, Book, and Contacts. They were designed as responsive pages that adapt automatically to any resolution device: desktop, tablet and mobile phones.

All this was possible using Bootstrap framework site that offers a lot of functionality in terms of HTML/CSS and JavaScript (getbootstrap.com).

7 Conclusions

This management system for an online library can be developed and implemented in any library of a cultural or educational institution. Operation is easy and allows recording of a book in the database, changes of book information, and new updates in the client list.

The benefits that this virtual library management system can bring users are:

- Efficiency, prompt and immediate response: the system ensures fast processing of inserted data inserted, at all times, allowing instant access to results and monitoring the progress of development activities within cultural and educational institutions.
- Safety in handling information and rigorous control of data access: technologies used for the conception and implementation of the application ensure maximum data protection and system information security.
- Management and sorting of information: information is organized effectively, so that the application enables quick search of required information.
- Flexibility: the app adapts easily to dynamic changes involved in activities of cultural and educational institutions.
- Substantial reduction of errors: through automation, the app ensures data accuracy, which means considerable reduction of errors caused by human factor.
- Availability wherever necessary: through the web portal, users can connect to the client application and may thus have online access to the services offered by the electronic books management.
- News section: here you can publish the latest information in the readers' interest areas, with the ability for users to leave comments.
- The opportunity to borrow a book in electronic format: virtual borrowed e-books can be read online from any Internet connected device.
- The ability to review and to rate e-books: this is very important for users who want to interact with other readers and know their reviews before borrowing an e-book.

This application can be used in libraries or bookshops management. This requires an additional research to address the specific needs of the areas. Therefore such an application is just a starting point and requires further research, adaptability to customer needs and open doors for keeping improving and creating new modules, so as to respond to technological innovations.

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http://xing.github.io/wysihtml5/
https://eonasdan.github.io/bootstrap-datetimepicker/#bootstrap-3-datepicker-v4-docs
http://www.jasny.net/bootstrap/javascript/
https://pdfobject.com/
https://revolution.themepunch.com/jquery/
http://suprb.com/apps/gridalicious/
http://getbootstrap.com/
http://www.w3schools.com/js/js_intro.asp
(All links accessed May-July 2016)

Distributed neural structures in adaptive eLearning systems

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Abstract

Adaptive eLearning systems are learning applications that can use machine learning techniques in addition to classical eLearning applications in order to enhance and achieve better results in the educational process. The Knowledge Discovery in Distributed Databases and Data Mining fields proposes the development of methods and techniques for assigning useful meanings for data stored in databases. Distributed Committee Machines are a combination of neural networks that work in a distributed manner as a group in order to obtain better performance than individual neural networks in solving data mining tasks inside the KDD process. In the tests were used classic multilayer perceptrons trained with the backpropagation algorithm to solve the standard classification problems. This paper aims to point the advantages of using Distributed Committee Machines in the Knowledge Discovery in Databases process and possible uses for such architectures in adaptive eLearning solutions.

Keywords: Knowledge Discovery in Distributed Databases, Data Mining, Distributed Learning, Adaptive eLearning

1 Introduction

Knowledge Discovery in Databases (KDD) is the overall process of finding and extracting useful patterns from data (Fayadd, U. et al, 1996).

The discovery of knowledge in databases interacts with many study areas such as machine-learning, pattern recognition in data, databases, adaptive eLearning, statistics, artificial intelligence, data acquisition for expert systems and data visualization (Fayadd, U. et al, 1996).

Data Mining (DM) represents a set of specific methods and algorithms aimed solely at extracting patterns from raw data (Fayadd, U. et al, 1996). The DM tasks are: classification is learning a function that maps (classifies) a data item into one of several predefined classes, regression – is learning a function that maps a data item to a real valued prediction variable (Fayadd, U. et al, 1996), clustering – is the partitioning of a data set into subsets (clusters), association rules – determine implication rules for a subset of record attributes, summarization – involves methods for finding a compact description for a subset of data (Fayadd, U. et al, 1996), dependency modeling – consists of finding a model that describes significant dependencies between variables (Fayadd, U. et al, 1996), change and deviation detection – represents the search for finding the most important changes in the data from previous measured values (Fayadd, U. et al, 1996).

In this paper we will focus on the classification task and we will propose a distributed adaptive eLearning architecture that uses distributed multilayer perceptrons with better performance than the classic centralized way of resolving the DM task (Pupezescu, V., et al, 2008). This architecture can be further used eLearning applications.

1.1 The Multilayer Perceptron

A multilayer feed-forward neural network is an artificial neural network model that maps input sets of data onto a set of appropriate output. An example of such network is shown in Figure 1. The input data are presented simultaneously to the input layer of neurons making the input layer. The second layer (the hidden layer – from such a layer we can't access the outputs) is fed with the weighted exits from the previous layer and so on. The number of hidden layers is arbitrary. The weighted outputs of the last hidden layer are input to units making up the output layer. The neuron-like units from the output layer give network's prediction for the given input data (Rumelhart, David E., et al, 1986).

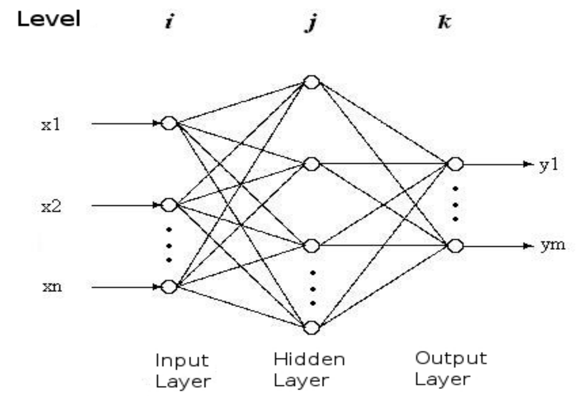

Figure 1. The Multilayer Perceptron

In order to start the training of the network one topology must be decided upon. Choosing the number of hidden layers and the number of neurons from each layer is a trial by error process. The initial values of the weights can have an important effect also on the final results in terms of accuracy and time execution.

The network is trained with the backpropagation algorithm. The algorithm can be divided into two stages as shown below:

The first step is to apply the input data to the network input units; the output of this phase is obtained after processing the input data presented in the entry (Rumelhart, David E., et al, 1986).

In the second stage, based on the error output calculated as the difference between the desired response(supervised learning) and actual output, the weights of connections between processing units are adjusted to minimize error in the next training epoch (Rumelhart, David E., et al, 1986).

Output error is obtained from the backpropagation algorithm. Learning takes place with decreasing output errors by modifying the weights between neurons. Once adjusted weights, the neural network has just learned from experience.

The neuron model used in the perceptron is the classical one.

The problems that will be analyzed with this algorithm are iris1, wine1 and conc1 data sets (http://mlr.cs.umass.edu/ml/datasets/Iris, http://mlr.cs.umass.edu/ml/datasets/Wine). We used the division by two at the activation function because the output data of the analyzed data are scaled between [-0.5, 0.5]. Based on these measurements we will determine if it is useful to apply simple MLP units or distributed committee machines in adaptive eLearning applications.

For the output layer of the multilayer perceptron we have the classical set of equations for correcting the weights (Rumelhart, David E., et al, 1986).

The data is arranged as follows:

$$TR=\{(\underbrace{\overline{x}, \overbrace{d)_{1,} \ldots (\overline{x}}^{trr}}_{trs}, d)_{tr}\};$$

$$TS=\{(\underbrace{\overline{x}, \overbrace{d)_{1,} \ldots (\overline{x}}^{tsr}}_{tss}, d)_{ts}\};$$

Figure 2. Data arrangement

TR represents the training data and TS represents the testing data. The analyzed data is kept in the database in the following configuration:

Table 1. iris1, wine1 and conc1 data sets

iris1	trr	tsr	trs	tss
Lines	100	50	100	50
Columns	3	3	4	4
wine1	trr	tsr	trs	tss
Lines	90	88	90	88
Columns	3	3	13	13
conc1	trr	tsr	trs	tss
Lines	200	100	200	100
Columns	1	1	2	2

In the following experiments we want to show that in complex classification problems (like conc1) it is very important to work in a distributed manner in order to attain better classification results. These results should be useful in determining how adaptive eLearning applications can benefit from working with neural architectures.

The implementation of the application was done in Java and the database management system chosen for the experiments was MySql.

The tests were done with different configurations of the multilayer perceptron. We used one hidden layer with a number of 2, 4, 6 and 8 neurons to see the individual behavior of the perceptron and the distributed behavior of the DCM. We made 12 tests with all the configuration in order to observe the average behavior of MLPs. The most important parameter is PCICtest[%] and it represents the percentage of incorrect classifications in tests (how many input data from the test set are incorrect classified) or the misclassification rate. The useful measurements were obtained within a limit of 1000 training and testing epochs.

Table 2. Classification performances

	iris1			
Hidden Neurons	2	4	6	8
PCICtest_avg[%]	20.83	8.5	4.66	3.83
	wine1			
Hidden Neurons	2	4	6	8
PCICtest_avg[%]	33.89	11	4.25	4.73
	conc1			
Hidden Neurons	2	4	6	8
PCICtest_avg[%]	44.58	38.5	28.08	23.33

The graphical representation of the result are these:

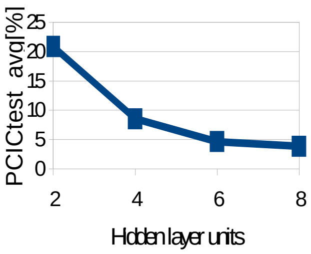

Figure 3. Single MLP run for iris1 problem

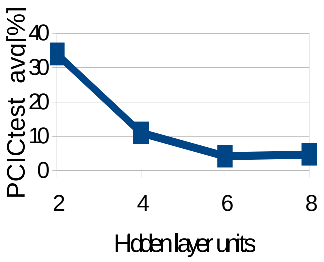

Figure 4. Single MLP run for wine1 problem

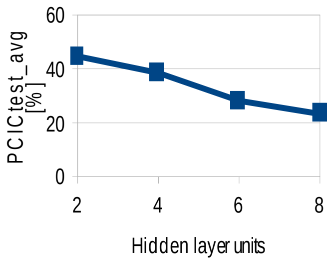

Figure 5. Single MLP run for conc1 problem

As we can see, if are used more than 6 neurons on the hidden layer for simple classification problems like (iris1 or wine1) one MLP obtains very good results (the average values of PCICtest in 12 tests were less than 5%).

However, on the more complex problem (conc1) the incorrect classification percentage was very high (the best result was obtained with 8 neurons in the hidden layer of the MLP – PCICtest_avg=23.33%).

The enhancements between the case in which are used only 2 neurons in the hidden layer and the case in which are used 8 are as follows:

[1] $E_{iris1} = \overline{PCICtest_2} - \overline{PCICtest_8} = 17\%$

[2] $E_{wine1} = \overline{PCICtest_2} - \overline{PCICtest_8} = 29.16\%$

[3] $E_{conc1} = \overline{PCICtest_2} - \overline{PCICtest_8} = 21.25\%$

In the following we will analyze the performances of the DCM architecture.

2 Distributed Multilayer Committee Machines in adaptive eLearning applications

Committee Machines (Figure 6) are combinations of neural networks that will work as a group in order to obtain better performance than individual networks in solving given problems (Pupezescu, V., et al, 2008)(Tahir, M.A., 2007). Distributed MLP Machines are a group of multilayer perceptrons (MLP) that work in a distributed manner to attain better results than only one MLP.

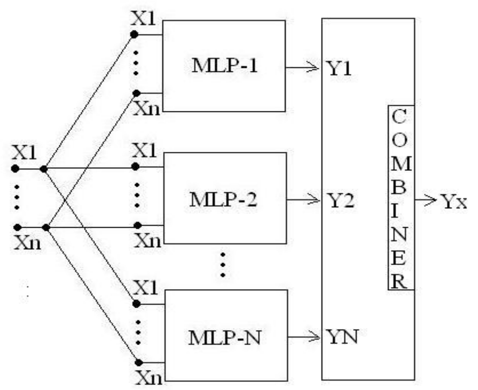

Figure 6. Distributed MLP Committee Machine

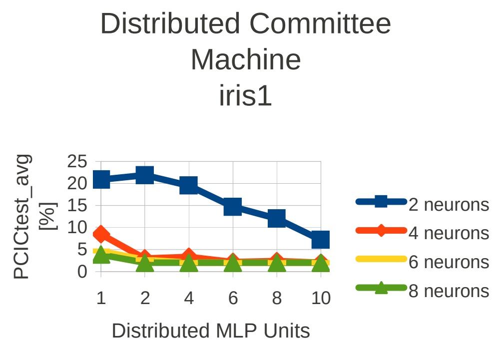

Figure 7. iris1 classification problem resolved with DCM

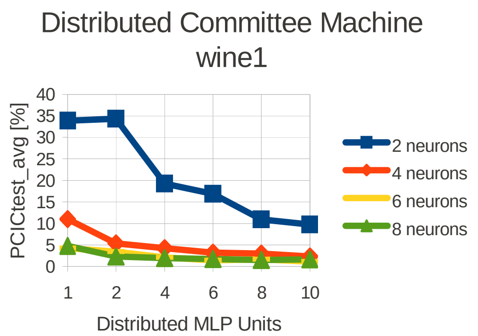

Figure 8. wine1 classification problem resolved with DCM

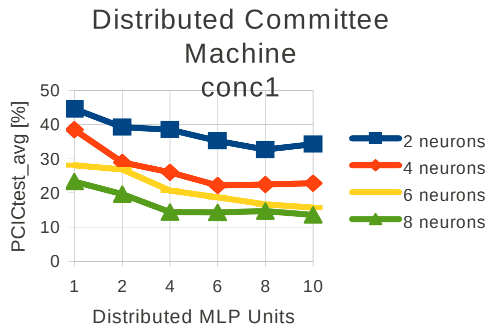

Figure 9. conc1 classification problem resolved with DCM

In the distributed experiment, the computing systems were approximately homogeneous. Each MLP units runs on a local machine with a local database. The classification performances are presented above.

The entire DCM system was autonomous. In the MLP CM, each MLP-block started with random weights and worked in parallel in order to reach a global error faster than normally. The result were dependent on the randomly generated weights so some of the MLP-blocks reached local minimums but some of them reached a global minimum. Each block had its error function. The final results were transmitted to the combiner in order to select the best result. As the experiments suggests, performances of the DCM structures are better on complex classification problems like conc1. On simple problems one MLP will have good results if it uses more neurons on its hidden layer. However, even on those problems the DCM obtained better results than one MLP trained for a longer period of time. In the conc1 problem, the DCM architecture (MLP units with 8 neurons in the hidden layer) had an average PCICtest_avg=13.58% compared to PCICtest_avg=23.33% in the individual tests (Figure 7, Figure 8 and Figure 9).

In the following experiments we analyze only the conc1 classification problem. The most important parameters for DCMs that will be calculated are distributed speedup(Sd) and distributed efficiency(Ed) (Ionescu F., 1999):

Distributed speedup represents the ratio between the execution time in the worst case of the fastest sequential algorithm (in our case of backpropagation algorithm) and the execution time in the most detrimental case of the DCM:

[4] $S_d = \frac{T_s}{T_d}$

[5] $T_d = max\{\overline{t_1}, \overline{t_2}, ..., \overline{t_n}\}$

[6] $\bar{t_i} = \frac{1}{N}\sum_{j=1}^{N} t_j$

In the present experiments N=12.

The distributed efficiency is given by the following ratio:

[7] $E_d = \frac{S_d}{n}$

, where n represents the number of slave machines that are linked with the combiner.

In order to compare the sequential execution of one MLP unit with the distributed one we chose a maximum limit of 1000 training epochs for each MLP unit from the DCM and a maximum limit of n*1000 training epochs for the single one, where n is the number of slave machines linked to the combiner.

For example, if we want to compare the execution of a DCM that contains 6 MLP units with sequential execution of only one MLP trained over a longer period of time we will measure Ts of 6000 epochs (the slowest execution time) against Td of 1000 epochs for the distributed machines (we will take the slowest machine from the DCM). The results (Figure 11, Figure 12) show that committee machines are much faster than the sequential execution.

A major advantage of the DCM over the classic execution is that each MLP starts with different random weight so the probability of having better results is increasing.

It is important to note that if we want to achieve the same classification results of the DCM structure in a sequential manner we must create the same MLP structures but the execution of each MLP should be sequential on the same computing machine.

In our experiments, for MLPs with 8 neurons in the hidden layer we had a probability Pr=100% in which we obtained better results than the sequential execution.

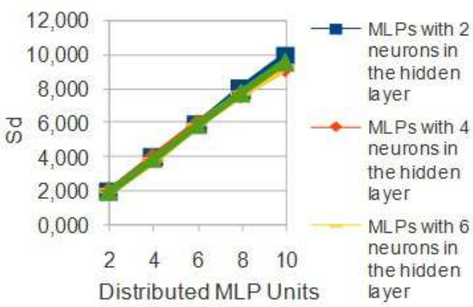

Figure 10. Distributed speedup

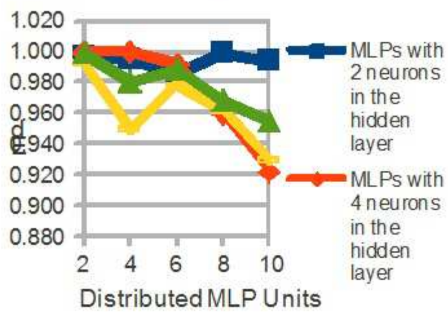

Figure 11. Distributed efficiency

All the results of the distributed speedup and efficiency were very good (Figure 10, Figure 11). For instance, the speedup had values equal with the number of systems used in DCMs and all values of efficiency were above 0.92 in all cases. Besides the high efficiency and good acceleration values the performances in classification were better when DCM were used.

We see the advantages of working with more than neural network in order to achieve better results so in the following figure (Figure 12) we proposed a distributed adaptive eLearning module based on previous work (Pupezescu, V., 2016) that can assist the educational process on an existing eLearning platform (Rădescu, R., 2011; Rădescu, R., 2010; Rădescu, R. and Davidescu, A., 2010; Rădescu, R. and Soare, B., 2014).

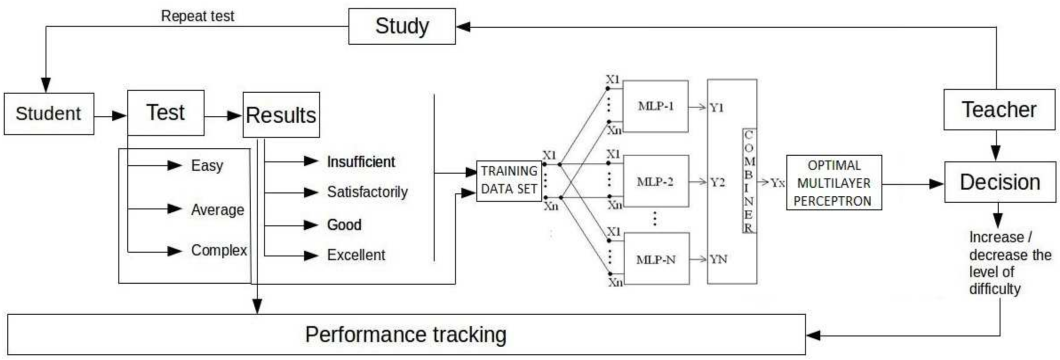

Figure 12. Distributed adaptive eLearning module

In the proposed adaptive eLearning module the student will give an assisted test. He will obtain a result which it will be written into the database that contains the training data set. The CM will determine in a distributed manner what is the best MLP structure that will be used for the student. The optimal neural structure will make a decision based on the students results of raising or lowering the level of the next test. The teacher will supervise the entire process and will decide if the student must go to study and give another test. All student's results will be stored in a database by a performance tracking module alongside the training data set associated to him.

3 Conclusion

In this paper we showed the advantage of working in a distributed manner in order to resolve the classification task from the KDD process. This way of working is suitable for more complex problems but the results obtained are better even for simple problems. We showed that we can use such distributed neural architectures in adaptive eLearning application with good results in terms of classification and execution times. The obtained results for MLP committee machines were better than the sequential execution of only one MLP trained over a longer period of time.

The fields that can benefit from using distributed MLP committee machines are various: medical diagnosing, medical research and strategies (strategies for games, business and war can be captured by analyzing the expert player's response to given stimuli), adaptive eLearning. If the problems analyzed are complex then distributed-committee machines are indicated to be used in classification than just one working unit. This working manner improves the overall KDD process.

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Software application for collaboratively studying foreign languages

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Abstract

This software application is intended to be used in the study of foreign languages. It's in the form of a chat and dictionaries laid side by side. The main idea is the way in which visualizing translations assists the process of learning. Above each word there should be an individual translation and below each sentence the whole translation. The software is constantly adapting the individual translations according to the most frequent usage. The users can easily contribute to the database through the chat and dictionary interfaces and make changes that instantly take effect and update the information to all current users. By introducing whole sentence translations, a statistical translation algorithm can benefit from the data using the parallel text corpuswritten in colloquial style. Each action is assisted by notifications of success or step by step instructions.

Keywords: Foreign language study, Chat, Translator, Dictionary, Collaborative learning

1 Motivation

People learn foreign languages in two different environments that are isolated between one another, namely the academical studies and everyday life conversations. Our goal is to bring these two environments together, each with it's own benefits that complement the other's drawbacks.

During learning [1], keeping the motivation and thus the attention at high levels is a challenging task. The environment we build helps people on one side to consciously seek information (as theoretical knowledge) for the sake of social interaction and unconsciously trains their skills (as practical knowledge) through pleasant interaction. As new information is gathered by the environment from the community, users will be able to benefit from the searching tools to customize their learning process, or an automated tutor could lead them through suggestions.

2 State of the Art

In the course of developing a software for the study of foreign language we carried out research in a lot of interdisciplinary domains such as translator types, dictionaries, linguistics. Computational linguistics [2] is addressing aspects of languages from a computational perspective through mathematical models and algorithms that test those models.

2.1 Translator types

Machine translation [3] is one of the most challenging fields of computational linguistics being considered "AI-complete" which means that it requires all human knowledge from grammar and semantics to knowledge about the world around us. At the start of computation, it was thought that implementing simple grammar rules would be enough to correctly translate between any languages, but today research is still carried out for this complex task to be continuously perfected.

Rule-Based Translation Software

Machine translation began as a rule based algorithm that translated according to predefined grammatical schemes. Words were translated, both meaning and morphologically modified according to grammar rules and put in the correct order as defined by the schemes of translation between two languages. Our application uses the idea of this in the process of individual word translation by translating the words and stopping before rearranging them, in order to provide the user with actual order of words in the studied language.

Statistical Translation Software

Then a new concept came up and statistical translation was invented. Statistical translation software[4] works by dividing the text of the input language and searching in a statistical manner the best candidate of the output language, after being previously trained on bilingual texts. During the training it detects used phrases in single language text corpuses and then searches parallel text corpuses for correlations and after which the building of statistical n-gram model is done, meaning they work by testing probabilities for different word length phrases. The first translation software used the word as a unit and a statistical model based on hidden Markov models.

Once phrases [5] began to be used as units, there were considerable improvements in the approach. There is also software that uses sentences as translation unit. Google translate first came out as a rule based translator and was quickly implemented as a statistical translation software by Och[6], who says that for a solid base that can be used to extract data for statistical translation models about 150-200 million words are necessary as a parallel bilingual corpus, and about a billion words as corpus for each language separately.

The texts of the United Nations used by Google Translate contain 200 billion words. Because of the corpus' source it performs very well in official style texts and not so well in colloquial style chatting. By contributing with translations of colloquial sentences, a corpus of parallel texts is formed, that can be used as data to implement a statistical translation algorithm. Google translate, as other software[7] also do, benefits from the corrections made by the community of users.

Due to the persistence of the personal translated texts and the social nature of the environment, the application built by us motivates users to naturally contribute while using it and helping others learn their language.

Testing Translation Software

BLEU [8] is a method to automatically test translation algorithms by comparing known translations of target sentences to the ones obtained with the tested algorithm. The accuracy is measured with 1-grams and the fluency with n-gram meaning it tests the best chosen word and phrases. It also takes into account if a phrase is concise enough. The algorithm's success is based on the cancellations of false positive and negative errors by testing large text corpuses.

2.2 Dictionaries

Wordnet [9] is a lexical database that is built as an ontology using OWL, and its structure can be easily used by programs. It has lexical relationships defined between words such as same, opposite, broader or specific meaning.

This kind of information is valuable when studying a foreign language. The database treats morphological modified words as belonging to the same instance while derivations and compositions are treated as distinct words. The vocabulary is defined as pairs of meanings and forms, and 17% of it is polysemic while 40% have homonyms, meaning they have the same form and the same meaning respectively.

3. General presentation

We wanted to provide an environment that is as much interactive and easy to contribute to it as possible, as well as very engaging. To be able to contribute we provided the users with a visual interface to most of the database dictionaries, namely the dictionaries for each language containing definitions, the dictionaries containing the forms of each morphologically modified word, the translation dictionary, as well as to the structures containing information for individual word translations and whole sentence translations. Interactiveness is achieved by attaching information to most of the displayed data. As an environment to learn and teach we chose a chat, making the learning process[1] a cognitive as well as a social process.

3.1 Technical aspects

The software application consists of a chat and two dictionaries side by side, running as a web application with clients connecting to a server that manages a database. Due to the amount of interactivity wished to be implemented and the data used in the application, Node.js [10] was used as a server with MongoDB [11] as a database. Both are free open source cross platform and very popular choices, included in the MEAN standard (MongoDB, Express.js, Angular, Node.js).

Node.js

The main advantages of Node.js are it's event-driven architecture that provides asynchronous I/O, the popularity of its scripting language namely javaScript, it's V8 interpreter open-source engine, and the cross platform capability of this framework.

Node.js was designed especially for bringing the advantages of event driven architectures to web servers, using callbacks without the need of threading. This server operates on a single thread by using libuv. The event loop is accessed through callbacks and it registers with the operating system, exiting when all callbacks are complete. This type of architecture is highly scalable and helps increase the rate of information transmission in web applications.

MongoDB

MongoDB is a noSQL database that uses JSON-like documents. The actual format of storage is BSON that stands for binary JSON. The database is non-relational and has a dynamic schema.

MongoDB does not have a visual interface and is accessible through CLI. All the necessary interaction was programmed by us, most of it being available visually through the web client interface, while some of it being automatic and carried out by the server. The database contains the dictionaries, the links between them and the message archive.

4 Use Cases

The program can be used either to learn or contribute with information, by multiple users or a single user, locally or over the internet (see Figure 1).

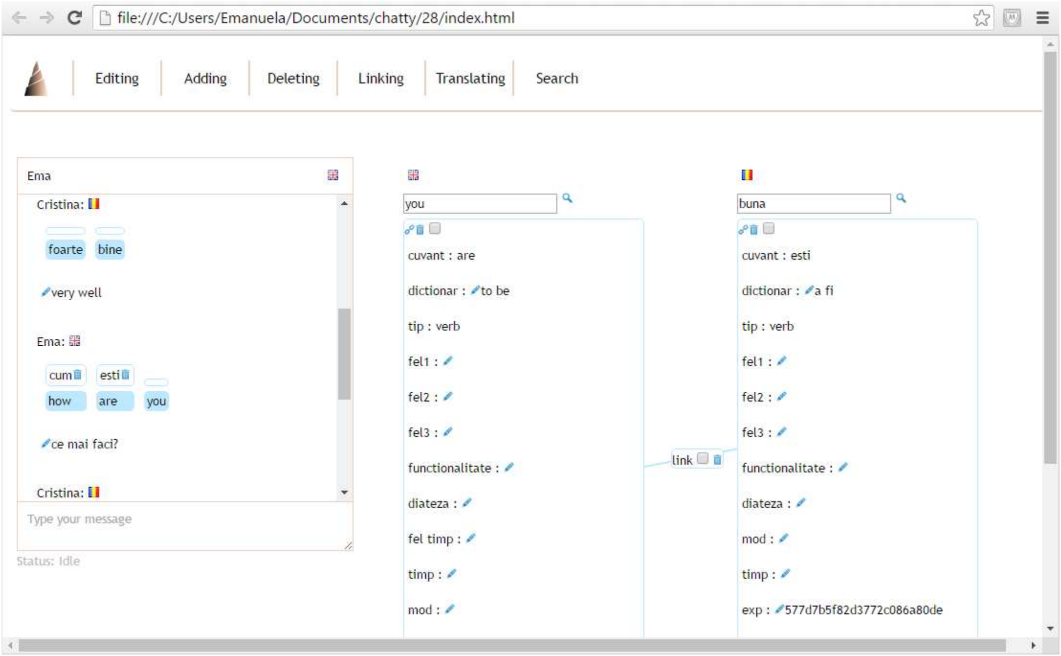

Figure 1. Screenshot of the application presenting the chat and the dictionary with links.

4.1 Activities

Contributing with information can be done in two main directions: towards individual translations or whole sentence translation.

The first step in adding information is adding dictionary forms of words. Afterwards morphological modified forms are added. Further, links can be made between a pairs of words of two different languages (as links between the two dictionaries), for marking translations.

After this process was complete automatic individual translations will be available for those words, and the software will choose according to the universally most used data. This is done in two steps, first the most used meaning among homonyms, then the most used translation. Users can further edit individual translations (as links between the link marking a pair of translated words and words contained in sentences written in the chat) and other data that was introduced as explained above.

Whole sentence translation are manually introduced. Users are motivated to introduce them because it helps them memories the full meaning. The database keeps these parallel text corpuses to be used later on in statistical translations, the only reuse of sentence translations right now being if one is retyped.

Information about words can be queried inside the database by clicking interactive spots, searching a word or completing a complex query.

4.2 User teams

We can imagine two main scenarios, one in which there is a teacher and a student, and one where two friends try to learn each other’s language. Other scenarios include individual users or multiple users.

Let’s say that a teacher of Latin language tries to tell a student how to write Latin, and they both share a common language further used in translations. He would use Latin sentences, while offering his student the information of their word by word meaning and whole meaning. At the same time the student can write from a book Latin sentences that he wishes to understand, and the teacher can input the individual translations where necessary and the whole translation.

If two friends don't share a common language communication is still possible, while learning each other's language. Let's say we have a Chinese and a Japanese. At first, the Chinese will only write Chinese sentences and the Japanese only Japanese sentences. While looking at the individual translations above the Japanese sentences the Chinese will understand the whole meaning of the sentence and write under it the whole translation in Chinese and the Japanese will do the same for the Chinese sentences. After they begin to learn some of the words they will be able to try to write the translation for their own sentences, and ask their friend to correct the translation. For example the Chinese will write a Chinese sentence and he will provide it with a naive Japanese translation, and wait for the Japanese to correct it and make it sound native.

Multiple users are an extension of the above said case and the architecture of the program permits a lot of simultaneous interaction.

Individual users can use the software while studying from a book because information would already be available in the system, and where necessary they can edit or add it. The instructiveness, the way information is organized and visualized helps them in their study.

4.3 Local and Remote

Each server is linked to it's own database and can be run locally or over the internet. Running it locally provides you with full control of data and privacy, and such a scenario is applicable to a tutor and student situation.

A server that permits connections through the internet would allow accumulation of information benefitting single users and multiple users that chat together but don't mutually master each other's language. Each server and database manage a single pair of languages.

5 Conclusions

Bringing the benefits of the information available in the academicals environment inside everyday life conversations that help easily assimilate concepts, creates a powerful environment for naturally studying foreign language in an advanced manner.

There are two main areas where improvements need to be done. First of all, this software application was intended to be a proof of concept, so most of the work was focused on implementing the interactivity of the chat and dictionaries. User accounts and database protection need to be implemented.

Growth of data available requires the design of visualization methods along with query algorithms especially for giving examples of word usage. Research will be further carried out in optimizing individual translations and implementing a statistical translator.

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Digital handbook of music: development principles

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Abstract

There are authors relate about development’s principles of Digital Handbook of Music elaborated by them, describing the types of didactic activities valued and incorporated in present educational software product in this article.

Keywords: Digital Manual (DM), interactive educational activities, analytical summary of DM of musical education.

1 Introduction in term of digital manual (DM)

Today more and more there are terms of digital manual (DM) and / or digital handbook (DH) in circulation. There given technological resources that define the phenomenon. Thus, Marin Vlada claims that: "In terms of technical / informatics, digital manual is independent from e-Learning platforms and is a software (application) that can be used online and offline, form any type of technology (desktop, laptop, tablet, phone), on any operating system and / or any browser and physically is be stored on a CD which is accompanying a printed version of manual. In terms of content, DM includes all of the content of printed manual (which has static representation), with complementary (instead of illustrations, tables, exercises, etc. on paper) specific elements such as interactive exercises, educational games, animations, movies and simulations by use cognitive bring more profit"(Marin Vlada, 2014).

1.1 Current conditions of technological development of digital manuals

Already after 2010 in the world, these educational resources in digital format have appeared in various countries including: France, USA, Russia, South Korea and United Arab Emirates. The research of existing DM’s diversity offered by various developers fron different countries allows us to come further both with a brief comparative analysis of their software applications and also to express our views across the set of opportunities integrated into DM products.

In **France** the DM's release are dealing many large firms such as *Hachette Education* (Jean-Thierry Le Bougnec, Marie-José Lopes, 2014) and *Nathan.* DM developed by Hachette Education (see Figure 1) is equipped with facilities that will be listed below:

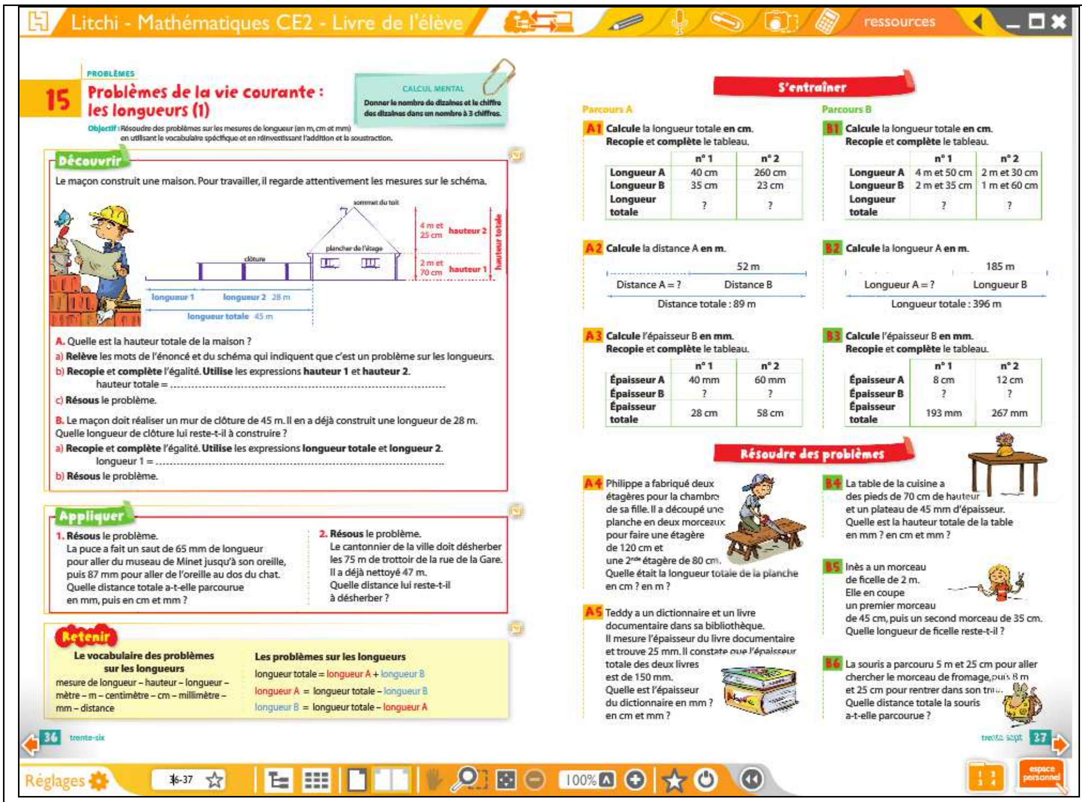

Figure 1. The sequence (pages 36-37) from DM "Mathematiques EC2", publishing house "Hachette"

A. Displaying of DM's didactical content can be made in a dual mode (one page each or two pages).

B. Various quick launch commands are displayed on the bottom toolbar: content; 100-400% zoom; magnifier (selective zoom); **espace personnel**'s icon (allows creation or importing of course's sequences); etc.

C. A set of other different quick launch commands which are displayed on the top toolbar: creation of annotations, sound sequences, adding of personal digital resources (files: audio, video, * .exe, hyperlinks from Internet, etc.).

D. MT is very well designed and adapted to be actively used on the interactive whiteboard.

DM version by publishing house "Nathan" is relatively simple, but has an access to contents; zoom x 4 and a flip type browse.

Today in **Russia** are launched several versions of DM at various undergraduate subjects. One of the largest scientific and educational centers in Russia which is preoccupied with such elaborations is *Publishing Group Incorporated "Dropha" - "Ventana-Graf" ("ДРОФА» - «ВЕНТАНА-ГРАФ").* All books published by concerned publishing house are integrated approved by specialized organizations from the Russian Federation, as Russian Academy of Education and Russian Academy of Sciences; and are included in the lists of federal textbooks recommended and / or approved for use in the educational process and implementing some educational programs of general educational institutions accredited by the state. On the company's official website are

presented elaborations of traditional textbooks and DM from over 29 fields of study of modern didactics, including early education and primary education.
Among Russia's successful development of DM there is also developed software according the musical manual of second grade, by Krasilinikova M.S., etc. (Красильникова М. С., Яшмолкина О. Н., Нехаева О. И., 2011) (see Figure 2).

Figure 2. The screen shows two pages of the DM's didactical content

Both, traditional version of manual and digital, are developed from the reason one academic hour per week. The textbook is designed to be used in secondary schools from Russia which has a theoretic profile of study.
DM aims to run both online and offline, on the personal computer of the student / teacher and is traded on the CD. DM demo version is available only to those interested in a volume of 10%. This DM has regimes: magnifying glass (Zoom) and two modes of teaching content viewing (by one page / or by two, see Figure 2).
On the toolbar placed in the basement of application are an interchange motor of (1) regime for reading and (2) the DM's operating mode. The second regime displays left sidebar that has placed on it a series of instruments such as: *Selection; Move; Mediateque; Summary; Search; The mode of connection / disconnection of additional* options, etc.
The typical activities integrated into Russian DM of music are: sequences' audition of musical works; displaying central definitions of musical terms in the dedicated text boxes; video streaming of famous musical works interpretations.
In the **USA** DM's development represents a large area of research. At present there are more officials DM developers in various formats. Thus there are: *Intel Company; Cnx Company; Chegg.com Company.* DM developed in US by listed companies have follows specific joint:
A. Display the DM's didactical contents in a format by one or by two pages.
B. Increase DM's content with a Zoom x 2.
C. Additional Menus for moving user from material's reading to print mode and/ or assistance system, etc. and vice versa.
As we talking about music DM developed and publicly available in the United States these are characterized by a total lack of interactive and multimedia activities. DM are available online, but only in various text and images formats placed on the Web (Arts and Culture Grade 5) given DM,

or, in our opinion, these are just some RD available online here, its are totally without any dynamic, both at a Hypertext, as a Hyperlink level. Moreover, we believe that for a music DM is absolutely inconceivable exclusion of listening exercises and analysis of musical works in various multimedia file formats, such as: * .AC3; * .AVI; * .f1c, * .flac; * .m4a; * .mkv; * .mp3; * .WAV, etc., moreover, there are an considerable numbers are available on the net.

At the beginning of 2014/2015 school year in **Romania** it was able to be developed several digital manuals (these are associated with classical, printed, manuals) for primary education (grades I and II).

In the kit launched in Romania are included digital manual (DM) at the subject *"Music and movement"* associated with the traditional music and movement manual published by “Litera” publishing house and recommended for second grade of primary schools.

The manual "Music and movement manual" launched by “Litera” published house, both traditional and digital versions, can be succinctly described as following:

A. Music and movement manual for second grade is divided into two volumes of three clearly structured units, which help both, teachers and students, to travel easily the curriculum content.

B. The printed version of manual is accompanied by digital, available on CD for the each semester.

C. Proposed exercises focus on creativity, communication and encouraging artistic skills of children through: songs (with the positive and the negative moments located in digital version of present manual), teamwork, learning through discovery, free expression, recreational activities, listening and moving moments;

D. Manual design is modern and attractive, and the explanations are accompanied by a lot of suggestive images to help child understand and assimilate information in a fun way.

After analyzing the set of determinations of both, DM and various elaborations of multiple digital educational products, categorized as DM, the most successful definition of DM we consider the definition by Marin Vlada.

And just because, on one hand, teaching process is an act of high creative work of pedagogue and the same subject / lesson can and taught in a different way by different professors, and the act of learning is an individual process, complex, intimate and again creative, of the student, on the other hand, we've added another idea Marin Vlada’s the notorious definition: **DM must have a powerful ability to be adaptable and personalized with educational activities as by teacher** *(with personal didactic resources developed and / or selected and / or integrated by teacher, but others who have developed training programmers, computer, etc.),* **as by student, owner of DM** (*this is, potentially, added with the results of educational activities undertaken in class or at home by the student owner of manual: drills already solved, video and / or audio records, etc.).*

We can safely say that music MD developed in Romania is more interactive than the Russian, sometimes with much more advantages than the US although there is a need for more profound perspective of presence / absence of the possibility to inclusion / establishment some tools for the user.

1.2 Contributing factors of technological development of DM in Rep. of Moldova

In 2015 in **Moldova** was proposed, as project, the concept of Digital Manual declaring several objectives for the development and implementation compartment of digital manuals (DM). This project included idea that the process of developing and implementing of DM tends to "modernize the informatics tools of students and teachers" (MERM, 2015, p.5), and the transition to a digital information environment is expected to be "positive and friendly" and "that would ensure a quality training" (MERM, 2015).

On official website of CTICE (Centrul Tehnologii Informaţionale şi Comunicaţionale în Educaţie a Republicii Moldova / Centre of Information and Communication Technologies in Education of

Republic of Moldova) can be found in free circulation all sets of manuals at all preuniversitary levels and disciplines in * .pdf format.

We're not sure where exactly these scanned, in * .pdf, books are the digital manuals those which is so speaking about, but the document reflected yet a different objective, and namely: "Another purpose of development and implementation of digital manuals is to provide access to all actors of the educational system to a volume *as possible expanded of modern educational digital contents, interactive,* **presented in various formats adaptable to the needs of each student,** *professionally designed in accordance with standards of: didactical, psychological, computer and design "* (MERM, 2015).

Computer scientists and developers of software products understand that such DM, which would correspond to the declared concept is not easy to create and that * .pdf format scanning not transform a traditional manual in a digital one.

2 Development principles of musical education's digital manual for second grade from Republic of Moldova

So we, present group of authors, proposed us a challenge that we should rise. Taking on the DM's based the music education printed manual, we filled learning activities existing in traditional teaching with interactive multimedia activities, as are expected, in fact, by the project concept of DM issued in Chisinau (MERM, 2015) (see Figure 3).

Enrichment activities of teacher's arsenal of musical education teacher: incorporated audio and video sequences; gallery of musical instruments; tools for embedded video and audio recording; Internet hyperlinks; embedded software for editing and playing sheet music; zoom local and global; the ability of the software to be projected onto the interactive whiteboard; DM orientation for both individual and cooperation work of students, as creation of, so-called, virtual classrooms reserved for lessons of given object of study.

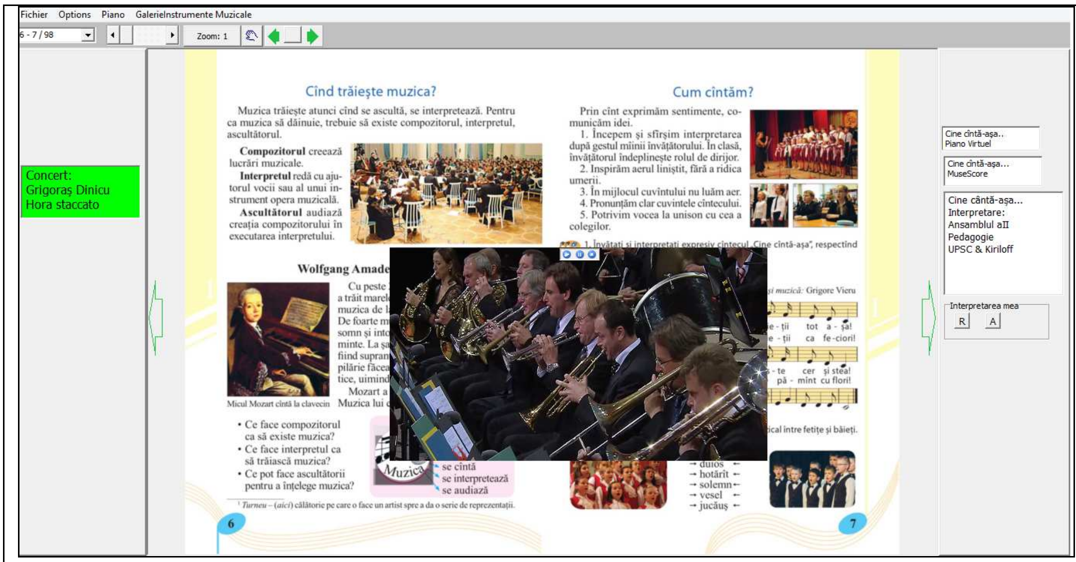

Figure 3. Immersion in concert atmosphere offered by DM musical education developed by present group of authors

Something special compared to other manual DM of musical education, there is incorporated software MuseScore's in present product, developed for editing and playing sheet music licensed under the GNU GPL requirements (users have right to use free the app). With this software have been created musical virtual of real music sequences present in the printed manual. Through a simple click user activates the virtual score and listen digital music, watching on portable note sounding at a given moment. Stave notes is interactive. The user has the possibility to introduce changes, checking its effect on hearing the final version of the musical score. With this software a student with a talent of a future composer can create own music and / or musical scores, repeating, perhaps, the great composer **Wolfgang Amadeus Mozart's** performance, about which are speaking to pupils on page 6 of the manual. Figure 4 are replicated the DM's sequence which are reproduce the folk song's melody *"Tell him by the small bagpipe"* ("Zi-i din cimpoieş") through software MuseScore.

DM version, designed and developed by us in programming environment Borland Delphi indeed provide both students and teachers a wider variety of educational content.

In general, the activities offered by a performance DM, no matter about what object of study it is speaking about: animation; simulations; educational games; galleries of multimedia clips with audio and video columns of studied musical works; complex evaluation activities, etc. If we are talking, in particular, about the activities implemented in a DM of musical education, it would be appropriate to value a set of teaching actions such as:

2.1 Exercises of musical listening

These activities include the audition interpretation of various musical ensembles, these are only three types: *vocal ensemble; instrumental ensemble; vocal and instrumental ensemble, representing a combined pattern of the first two musical groups.*

Such an DM of musical education, according to the authors conception is able to provide a support directly from digital music book, in the classroom or at home to every student who consults DM numerous auditions for musical ensembles of diverse artistic composition and content: bands or music groups; choir; chamber music ensembles; orchestras; vocal ensembles; ensembles of wind instruments and / or stringed instruments, etc.

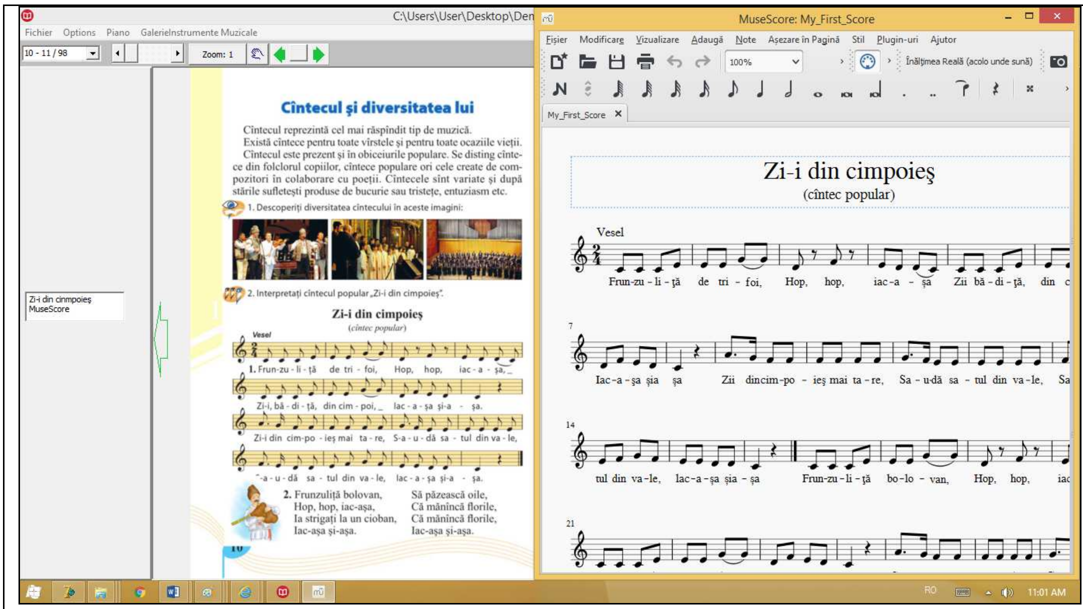

Figure 4. The reproduction of folk song's melody "Tell him by the small bagpipe" ("Zi-i din cimpoieş") through MuseScore software, incorporated into musical DM of authors

In fact, the organization of didactic work like this in real life would require, ideally, at least one visit to the concert hall for musical audition pieces in interpreting of teams. So then, there is one concert ticket for each type of ensemble here.

There are alternatives, some would say, can make listening to music and views of the interpretation of music on TV, radio, YouTube, etc.

But here's a need for a minimum selection criteria for:

A. Item must meet the requirements as mentioned in curriculum for every discipline and age;

B. The musical video clip is better to be selected in accordance with the particular manner of performing classical musical work in question;

C. The devices (TV, radio, computer, speakers, sound card / video, etc.) whose quality must be able to adequately reproduce the beauty and depth unrepeatable piece of the musical heard.

Additionally, an essential aspect of any type of assembly is that each member of the group must show responsibility and professional competence, which is particularly evident at soloists and conductors (see Figure 4).

From this we can deduce a few more priceless learning activities that can be offered only by own conception' s DM for musical education. These are:

2.2 Immersion in concert atmosphere for listening musical works in musical collective interpretation of more or less famous - classical music orchestras; folk; choir, etc. (See Figures 3-4), recommended by M. Morari, etc. (Morari, M. and Borș, Al. and Coroi, E., 2015).

2.3 Overseeing the conductor in various types of collective-instrumental music - classical music orchestras; folk music bands; choir, etc. (See Figures 3-4), also recommended (M. Morari. Al.Borș. E. Coroi, 2015).

3 Conclusions

Versus * .pdf manual version, such a DM's format of musical education with a potential to run successfully on a broad spectrum of various digital devices as: computer, tablet and smartphone, or projected as the interactive whiteboard is skillful that is truly transforming early childhood, primary pupils into active members of the learning process and facilitate teaching of didactical content at the musical education discipline in primary and pre-school education institutions from the country.

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Design and Engineering of Software Applications for Touch Input Collection on Mobile Devices

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Abstract

Recent advances in input technology have made touch screens the dominating interface for mobile devices and tablet computers. We developed in this work four applications that record users' touch input (taps and flicks) in both experimental and live settings. In this paper, we describe the design and development of these software tools. The variety of touch data reported by our tools (e.g., touch locations, timestamps, pressure, touch area, and device movement) will be useful to researchers to better understand users' touch input performance.

Keywords: Touch input, Gesture input, Mobile devices, Software tools, Android, Touch screens, Experiments, Touch measurements

1. Introduction

Gesture-based interfaces have had great impact on today's computing systems while smart devices allow human gestures to be captured in various forms. Previous studies on touch screen technology revealed that users prefer gesture commands that are different from those proposed by experienced designers (Morris et al., 2010); users are highly consistent with themselves when producing gestures (Anthony et al., 2013); users have various gesture preferences and still reasonable agreement levels can be established (Wobbrock et al., 2009); and that gesture execution in public depends on location and audience (Rico and Brewster, 2010).

Despite current efforts to recognize gestures on mobile devices and to understand how users articulate touch and stroke gestures (Anthony et al., 2013; Asbrook and Starner, 2010; Ruiz et al., 2011; Vatavu et al., 2013), we believe that the HCI community will benefit of more software tools to readily record users' gesture input in controlled experimental settings.

1.1 Paper Contributions

The tools that we present in this paper can be used to collect various gesture data, see below, and they offer the researcher a complete and unique dataset with gesture descriptions, composed of many touch related measurements. This data can be used as training for gesture recognizers or for evaluating gesture input performance directly. Our software tools will enable researchers to readily collect users' input on mobile devices.

2 Design of applications

All the applications were developed to meet the following requirements: quick time response, suitable processing algorithms, separation of gestures from involuntary touches. Our software tools run on Android and they collect touch gestures and other information regarding the device using the embedded accelerometer. All the data is recorded in XML files and consists of touch coordinates, area size of the fingers touching the screen, the pressure exerted by fingers on the touch screen, the number of fingers used, the timestamps of the touch events, duration of the touch trials, and device orientation.

2.1 TapExperiment application

Targets are displayed on the screen in the form of circles that users must acquire as fast and accurately as possible. After each tap, the target changes location on the screen and also may change its size. The application is locked on the device's screen in order to prevent erroneous data recording by accidentally shutting down the device, tapping its hard and/or soft buttons or to prevent the display of third party messages on the status bar. We preselected the default size of targets following Google's recommendations (48 × 48 *dp*), because the average size of an adult thumb pad is about 10 mm.

Figure 1. TapExperiment configuration interface

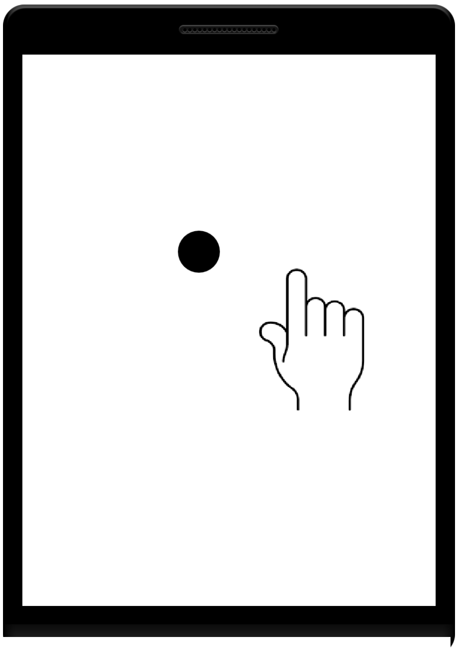

Figure 2. Testing TapExperiment application

The application was designed to be device independent considering that Android systems run on a variety of devices with various screen resolutions and form factors. Although the operating system resizes automatically the application, we made sure that the targets are displayed correctly according to the device *dpi*.

More complex touch experiments investigate how users can acquire targets displayed near the margins and in the screen corners, although the central area has the highest visibility and elements placed there are easier to touch. Therefore, approximately 90% of all targets are automatically placed in these challenging areas, while the rest are located in the center. The display modality is the same for all targets: black targets on a white background.

Once the application is launched, users can go through a training module or can start directly the experiment (see Figure 1). The application displays targets sequentially (see Figure 2). Users must acquire each target before proceeding to next one. A validation algorithm determines if the touch point (captured when the user lifts the finger) is below a certain distance threshold from the center of the target. If the user fails acquiring the target accurately, they will receive a warning.

The TapExperiment application records the coordinates of the touch events, the pressure exerted by the finger on the touchscreen, device tilt, the task time and the touch time, the IDs of fingers touching the device, the medium acceleration of device on all the three axes, the size of the touched area, the target's radium, the offset between the target's center and the point where the user lifts his finger from the touch screen.

2.2 DensityTapExperiment application

The DensityTapExperiment (see Figures 3 and 4) collects users' touch input for scenarios where multiple targets are displayed close together, i.e., high density of targets.

Figure 3. DensityTapExperiment configuration interface

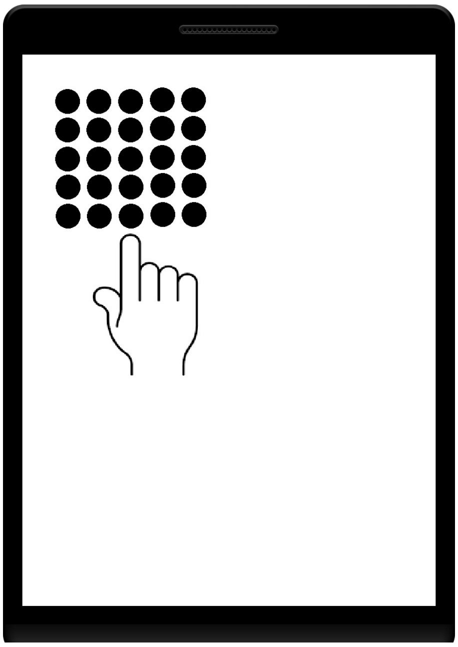

Figure 4. Testing DensityTapExperiment application

The application displays a matrix of 5×5 targets and the user's task is to select the target in the center (see Figure 4). The location of the matrix varies randomly on the screen, while the target's radium and the padding between targets are configurable.

The recorded parameters are: coordinates of the touch event, the pressure exerted by the finger on the touchscreen, device tilt, the ID of the fingers touching the device, the medium accelerations of device on all the three axes, size of the touched area, the target's radium, the padding value between targets, the offset between the target's center and the point where the user lifts his finger from touch screen. We also record time related parameters, such as the task time and touch time.

2.3 MovingTap application

In order to collect users' tap gestures for a moving target, we developed the MovingTap application. The application allows to set the target's radium and the movement speed from the configuration page (see Figure 5). By default, there are 5 values for target radium and 3 different speeds.

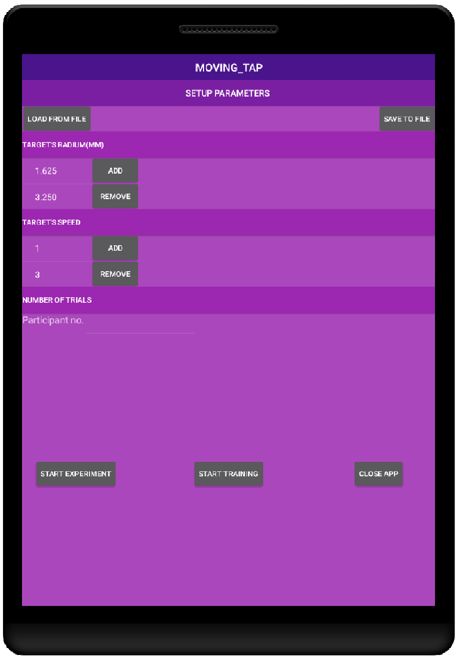

Figure 5. MovingTap configuration interface

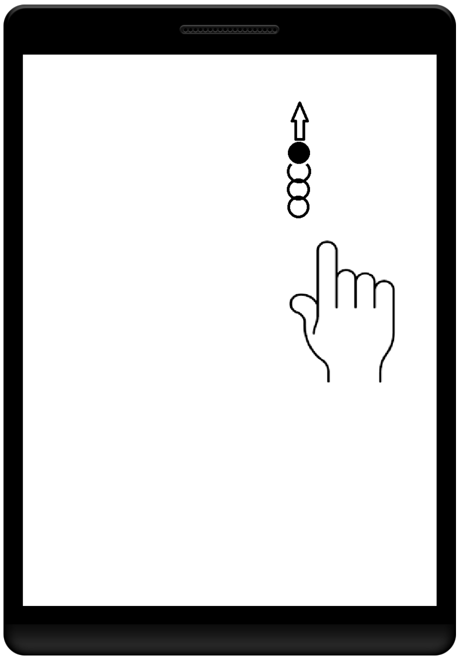

Figure 6. Testing MovingTap application

The application displays a target that is moving up and down or from left to right waiting for a user to touch the screen. The area where the target is placed is randomly changed for every trial. By default, there are implemented 3 different target velocities: slow, medium and high.

This software tool records the following parameters: coordinates of the touch event, pressure exerted by finger on the touchscreen, device tilt, the IDs of finger on the touchscreen, the medium acceleration of device on all three axes, the size of the touched area, the target's radium, the task time, the touch time, the offset between the target's center and the point where the user lifts his finger from touchscreen. We also record target related parameters like the radium and speed.

2.4 Drag and Drop application

Drag and drop is a technique for manipulating digital objects on a visual graphic interface. Very popular among PCs users, it has become a key element for touch screens as well. Therefore, we implemented a new application to collect users' drag and drop gestures. The measurements that the application records are: reaction time before the target is touched, the time needed to accomplish the task, the fingers' path from the start point to the destination and the number of fingers that touch the screen during this time, the distance between target and destination, pressure and touch area size. We also record device-related parameters, such as accelerated motion and device tilt.

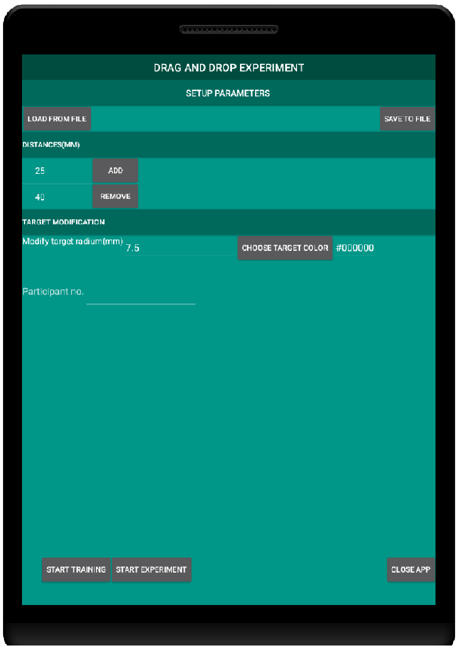

Figure 7. Drag and Drop configuration interface

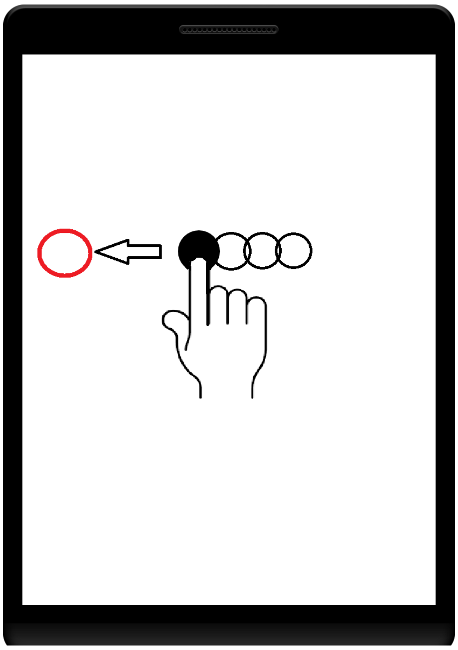

Figure 8. Testing Drag and Drop application

3 Conclusion

In this paper, we presented four software tools that collect users' touch gesture input. These tools are designed to run on Android devices. The variety of data and touch measurements collected will help researchers in their studies to design more efficient interfaces for users and especially for those with sight impairments. The software tools are free to use and can be obtained by contacting the author.

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Educational Aspects of Market Mapping: Student Learning of Economic Issues Regarding Markets Using a Model Based on Graphs

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Abstract

Modelling an economic environment has implications even behind the immediate ones. Besides the research made and the powerful economic aspect that is emphasized, the model and simulation of an economic context can have important educational usage for students who learn economic concepts. Based on a research made on a particular geographical market of Şerbănești village from Olt County, in this paper we will show the importance of ICT-based tools and algorithmic notions for understanding the underlying mechanisms of an economic market.

Keywords: Map, Graph, Market, Economic, Learning

1 Introduction

Mapping an economic market, regardless its type, roughly means to identify its main components/entities and to establish the relations/connections that can be made or exist between these entities. Basically, a model can be made in order to represent schematically the parameters and the functionalities of such a market (Tița, 2012).

An economic environment is quite complex to be modelled and even harder to be simulated, because of its large number of variables and their unexpected behaviour. However, the representation of components and relations between them can be approximated and used further in a specific domain (Geunes, 2005; Nagurney, 2006; Stadtler, 2005).

Why such a representation is made and what is its purpose? This representation can be made in order to make an inventory of the enterprises within a particular market (based on certain geographical, typical characteristics etc.).

We will present in this paper a possibility of using this type of model within the education of the students that chose to study economic disciplines. This would consist in the future as a tool that can be integrated in the individual style of learning of each student, whose ways of implementing within education will be presented in section 3.

This representation can be extended to other levels of economy. Thus, while building a map of an economic context can be considered as belonging to a level of mid and macro-economy, a representation of departments of an enterprise can also be made using the same model. An instance of the first is presented in section 2, while a representation of the latter, which can also be used for individual learning, is presented, as we presented, in section 3. Section 4 will present premises for integrating the model within the educational process (in models, organization etc.).

2 Description of the Model

The model of an economic map is structured using graph (for visual) and matrix (for storing values) structures. Graphically, the model has two basic elements: the enterprises (represented by nodes) and the relations between them (represented by edges between nodes). We have presented the economic map of a geographical area delimited by the territory of Șerbănești village (Bold, 2016). The study was run in two main components:

- the building of the model, by searching and adding information for the main components (every enterprise being characterized by 15 parameters), as well as determining an affinity index based on certain components;
- the simulation of the model, made by determining the potential connections between the enterprises and running various scenarios determined by changes of different parameters or creation of certain enterprises.

A graphical representation of the model for Șerbănești village is shown in Figure 1.

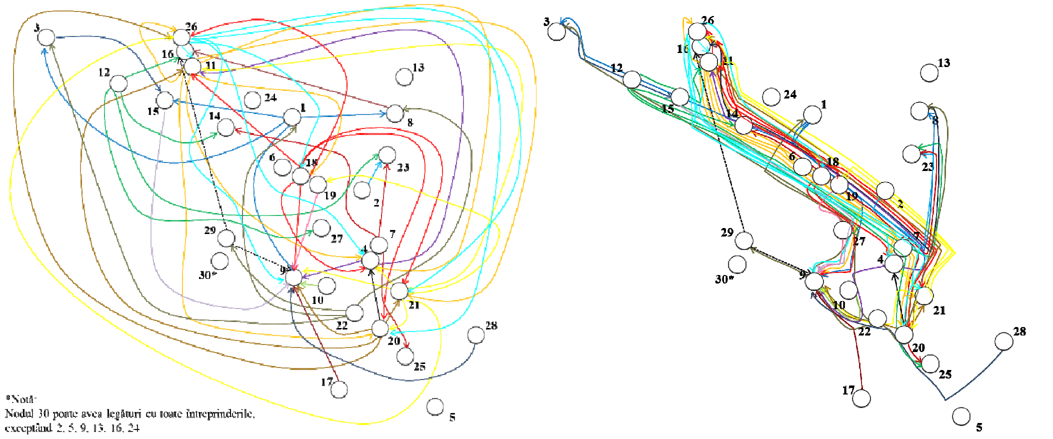

Figure 1. Graphical represntation of the economic map for Șerbănești village

The system is built on the premise that an entity is, in the same time, provider and client. The provider (denoted by P) is the entity that furnishes goods and services and the client (denoted by C) is the one that receives them.

The creation of the model, that will be called generically „the economic map”, has practically the next steps to be completed:

Step 1. All the data is taken from the environment. The information that must be known consists in 15 characteristics of an enterprise/department: name, order number, turnover, profit, year of establishment, geographical coordinates (latitude and longitude), input keywords, output keywords, domain of activity, description, number of employees, size, degree of trust, the position(s) of the enterprise on the food chain.

The most important characteristics from the list of 15 are the input and output keywords. Using the simplest explanation, the input keywords contain raw material and other materials used for the good or service and the output keywords are the goods/services that the enterprise sells.

Step 2. The read data is used to determine the general affinity index (GAI), based on five types of interactions (affinity indexes - AI) between the enterprises, in order of their importance:

- the keyword-based affinity index (KAI) – it can have two values: 0 and 1. It is determined by comparing the output of P with the input of C. If at least one match is found, the index is 1 and 0 otherwise.

- the geographical distance affinity index (GDAI) – basically, the bigger the distance between two entities, the lower the value of index will be. This is made by finding the largest distance between two elements and reporting every distance to this, obtaining values from 0 to 1 (*i*,*j* are two entities, *gd*(*i*,*j*) is the geographical distance between entities *i* and *j*):

$$[1] \quad GDAI_{(i,j)} = \frac{gd_{(i,j)}}{\max\left(gd_{(i,j)}\right)}$$

- the category-based affinity index (CAI) – this is based on the general affinity between categories of CAEN code (which contains codes from A to S, with other many subcategories);
- the human affinity index (HAI) – this index is determined by the interpersonal intensity of human interaction between managers of these entities;
- the trust affinity index (TAI) – determined by the degree of trust that the entity C has depending on its profit rate trend calculated for the latter years of activity.

GAI is a float number between 0 and 1. The initial equation used to calculate the GAI is, practically, a weighted average between the five indexes, with a given weight for each index. Researches are being made now in order to optimize this mode of calculating the GAI. A more schematic view of the representation of GAI is presented in Figure 2.

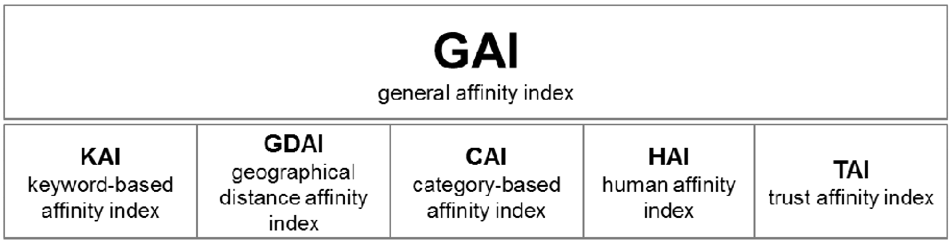

Figure 2. Schematic view of GAI

Based on GAI, a matrix of general affinities (E) is made for all the entities. For an element of this matrix *i* the *i*-th row represents the GAIs of *i* as provider for all the other entities and the *i*-th column represents the GAIs of *i* as a client for the other entities.

Step 3. The relations between entities are now established. It is considered that an establishment of a connection between entities *i* (as P) and *j* (as C) is made when the $GAI_{(i,j)}$ larger than 0.5.

Then the system can be simulated, by determining directions of development or simulating situations when new entities are formed. We have formed some methods for simulating the model (Bold, 2016).

3 Usage of the Model for Learning

The legitimate question that arises in this case is: why is this system usable within the process learning and how this integration can be made?

To respond to the first question, we will take a short example of using the model for a specific enterprise (Drăghici et al, 2010; Stoian et al, 2011). This example will show the representation of the departments of the enterprise and the way these departments are relating to each other.

We will take as example an NGO located in Slatina. This NGO is Proeuro-Cons Association (PCA). Its main departments with the characteristics are presented in Table 1.

Department	Codification	Input keywords	Output keywords
IT	1	IT_equipment, electricity, software	social_media, IT_consulting, IT_repair
Marketing and PR	2	papers, documents, IT_counseling, IT_repair	marketing, statistics, advertising
Training	3	papers, trainers, monitors, statistics, IT_counseling, IT_repair	training, training_papers
Human Resources	4	statistics, IT_counseling, IT_repair	trainers, monitors, assessment, salary_papers
Administration	5	salary_papers, training_papers, financial_fact, IT_counseling, IT_repair	
Accountability	6	salary_papers, training_papers, IT_counseling, IT_repair	financial_fact
General management	7	salary_papers, training_papers, IT_counseling, IT_repair, training, statistics, marketing, financial_fact	salary_papers, training_papers

Table 1. Departments of PCA and some of their characteristics

After the run of the implementation of the method, we obtained the network presented in Figure 3.

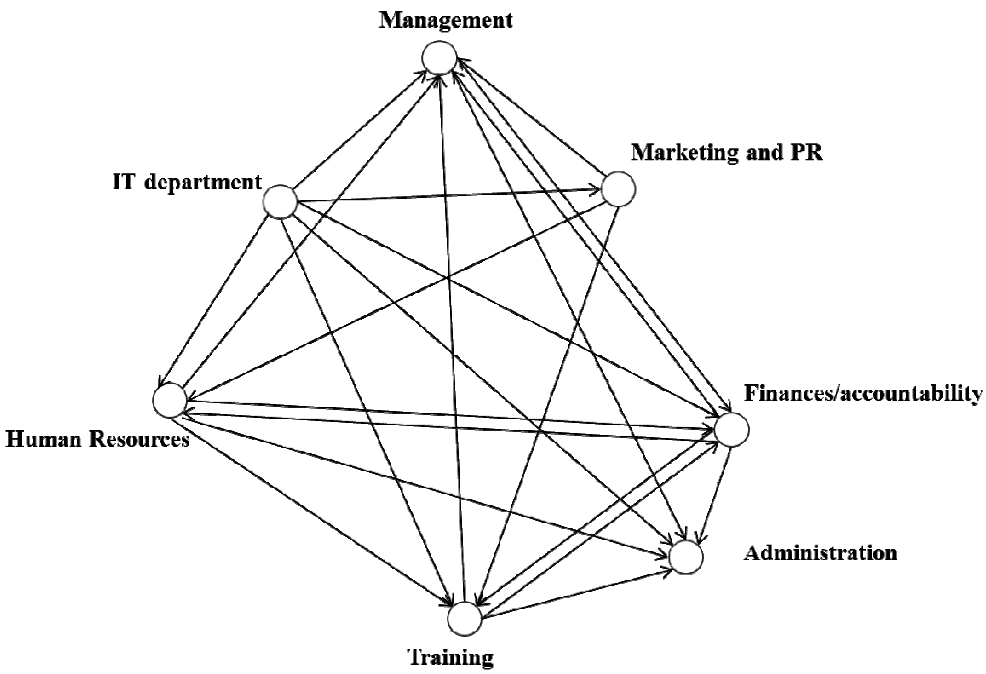

Figure 3. Output of the implementation for PCA

As we can see, the model outputs a structure that can be viewed graphically. Thus, this easiness in reading the output data makes it relatively easy to understand. The representation helps, mostly, in observing the relations between the departments from a company or enterprises in a market (as seen in section 2), thus the student can easily understand the dynamics that are present between the studied entities within the given context.

The integration of this model within education could be made on an individual basis, the student understanding better the concepts studied in class after studying the relationships presented above.

4 Extending the Concept within the Educational Process

The concept of modelling several entities in order to find the relationships between them and to simulate this model is not quite novel. Stepping forward, we can transpose the model from an economic topic to the level of organizing sequent process within the educational process or observing the linking structure between several concepts to be studied in a period of time in class. These two ideas can be used successfully in the process of organization of education, consisting in a generator of flows regarding the concepts that the student will follow.

For example, a course of English Grammar would have as “departments” the main concepts to be achieved by the students (the noun, the adjective, the verb etc.), every concept being delimited by sub-concepts (as input keywords, the needed sub-concepts for the study of the main concept and as output keywords, the learned sub-concepts). Slight modifications are made to the initial model, given by the modifications of the characteristics of the departments. These departments would turn into “providers” of information for the “clients”, the “departments” being followed in a sequent order. The weight of the relation would consist in the number of common sub-concepts. After the relations between them are set, the model would find the fittest road between an initial concept and a final one. In an algorithmic transcription, this would consist in finding a road which maximizes the flow and visits all the nodes in an oriented graph. A graphical output of the idea can appear in the form would resemble as the one presented in Figure 3, also with the determination of the optimal path between all the concepts (modules). This would consist in a future work of the authors, in order to make the necessary requirements to this specific form of a model.

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Application software architecture for learning physics, based on Ant Colony Optimisation type mechanisms

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Abstract

The proposed software architecture is based on the existence of a parallelism between technique - Ant Colony Optimization (ACO) and learning disciplines based on experiments. Also, simultaneous completion of several routes in the ACO framework, implemented by multitasking techniques, may correspondent peer learning, each student having his own route in the learning process. This learning can be achieved in an online environment, they communicate with each other and in which each student can evaluate its level of understanding. In such an architecture student choosing the right solution can be reached in several ways, some simple and others complex. The idea is that the solution must reach in as few steps as possible, or in a minimal time. Finally, as in the ACO algorithms, students will take the best route which corresponds optimal solution for solving the problem of knowledge.

Keywords: Ant Colony Optimization, software design,

Introduction

In the learning process of the disciplines based on experiment, we have a number of similarities with ACO algorithm such as those given below:

Table 1: Similarities learning process - ACO algorithm

Learning process	ACO algorithm
The learning process for one student	The route/path for a single ant
The steps/stages of the learning process	The graph nodes that are traversed for an ant
Replay of clear steps in experiment, in order to understand other steps	Multiple use of the same routes for an ant that causes an increased amount for pheromone
Exchange of experience with other students who learn the same thing	The other ants go through the graph, their objective is the same. They use in the search process pheromone produced by other ants.
Forgetting due to interruption of the learning process or erroneous steps.	Evaporation pheromone after some time

In an application learning experience exchange between students can be achieved in a controlled manner via a graphical interface and a software module that allows quantifying and recording the successes and failures of learning.

Overview About the Design of the Software

Initially, it builds a graph based on intermediate steps in the learning process and possible options based on input data selected by the student. (Figure 1).

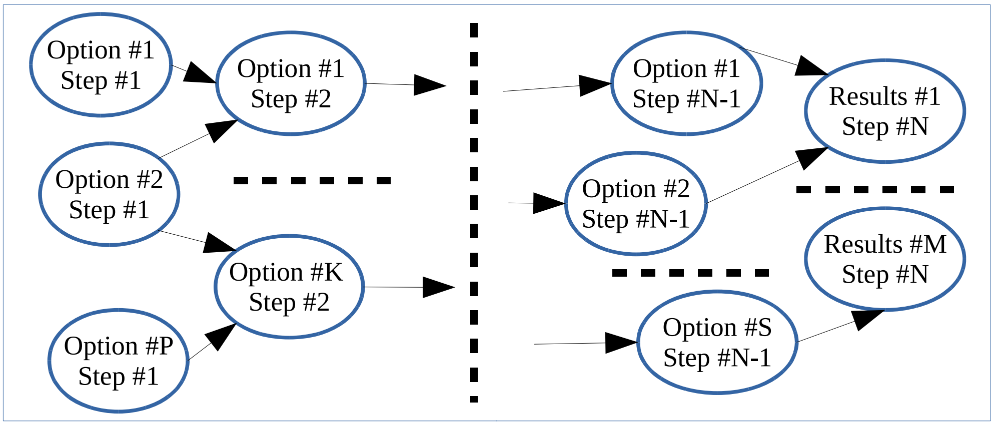

Figure 1.Construction of the graph

Data entered by the student after training process are assessed at every step. These data will be stored in a database in order to evaluate the overall learning process (Figure 2).

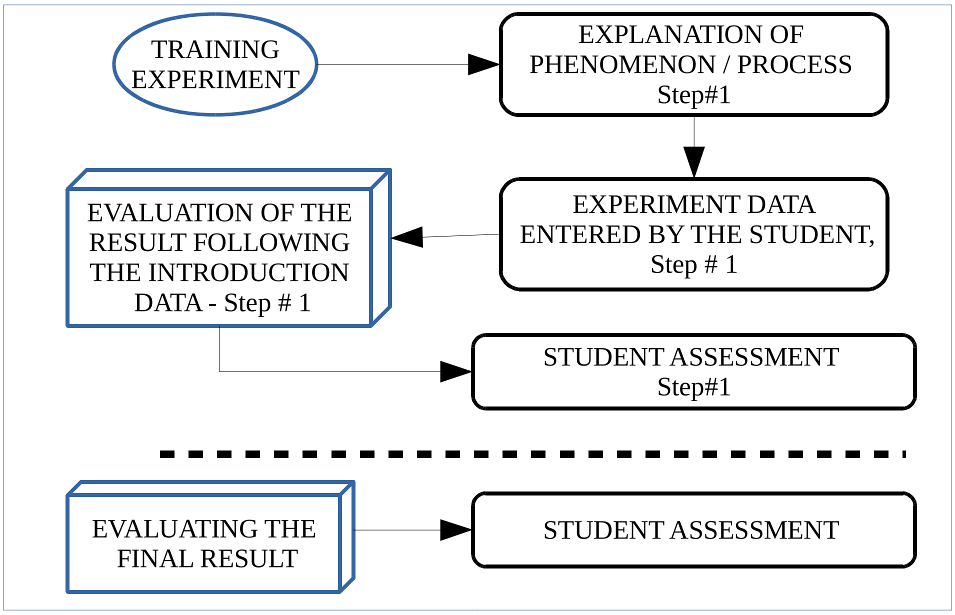

Figure 2. The learning process

More students can use simultaneous instances of the application and they can be studying the same lessons at different stages (Figure 3). Stages / steps are predefined in the application configuration so that it can be used to communicate with other instances of the application. For each student will be stored data entered / selected by the student for that step and the data resulting from the simulation at that step.

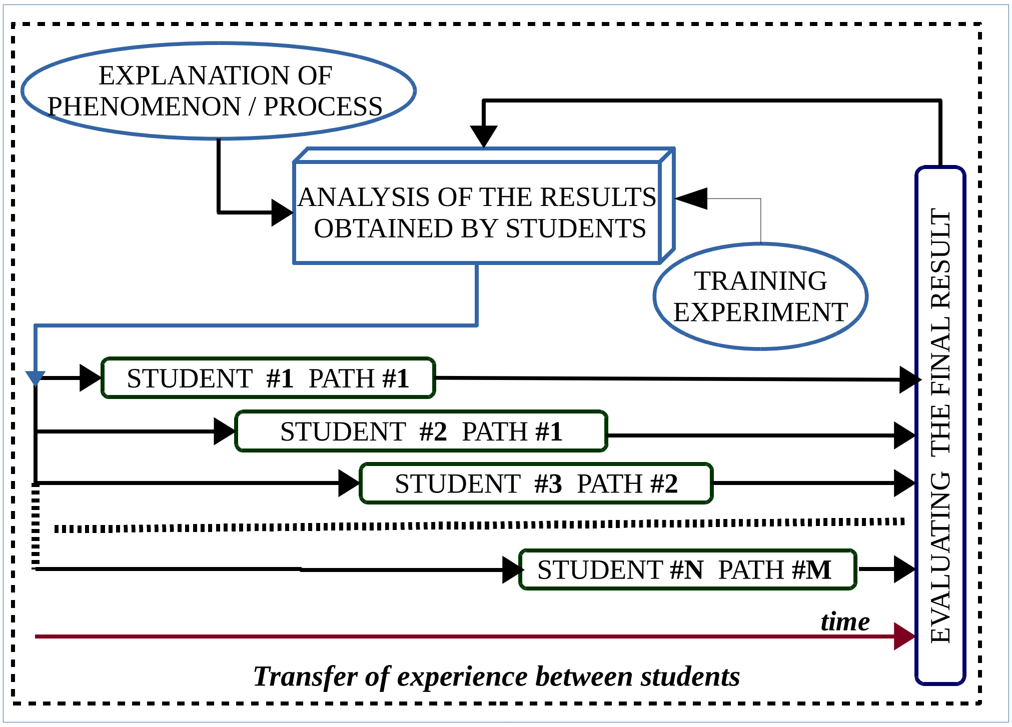

Figure 3. Transfer data

Each *path* consists of the multitude of steps achieved in learning a lesson. As with the ACO will be selected paths to achieve the desired result in a minimum number of steps.

Software Architecture

The software uses three databases:

- a database with the specific rules of each lesson - detailed information at each step, they are represented by input-output type rules for each step;
- a database with partial assessments at each step - detailed student data inputs and the respective result, are stored including erroneous steps;
- database experience of other students; it has a similar structure to the local and depending on application architecture can be shared with one containing partial assessment of current student or be separated (when data is stored locally).

In the simulation module are built "model answer" for the application corresponding to each input data variations.

The input data for each student are taken through a graphical interface mode. Interfacing with the data of other students is achieved through an interface module that analyzes data from the database. The data resulting from this module are compared with data input-output specific learning process. Based on the results can decisions be taken on improving of the software performance. Frequency of going through certain steps will correspondent ACO pheromone intensity. The length of time since the last traversing a step will have as a correspondent in ACO pheromone evaporation. The general flow is shown in Figure 4.

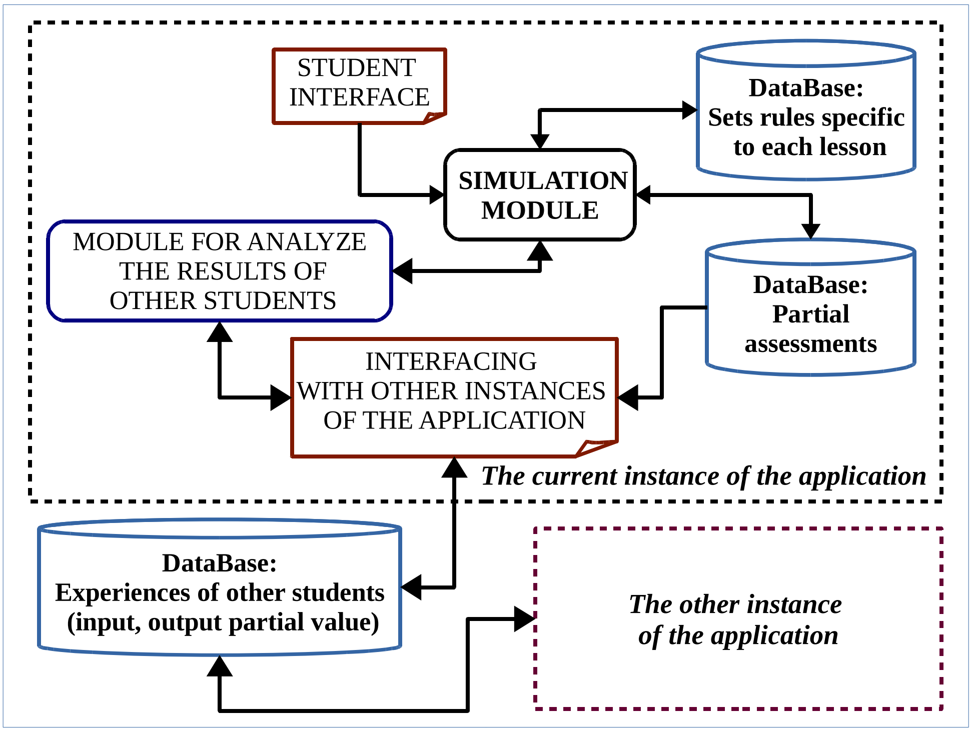

Figure 4. General flow

One way of building class "Simulation" is given in Figure 5. In this example is used multiple inheritance, inheritance that can be implemented using C ++ language.

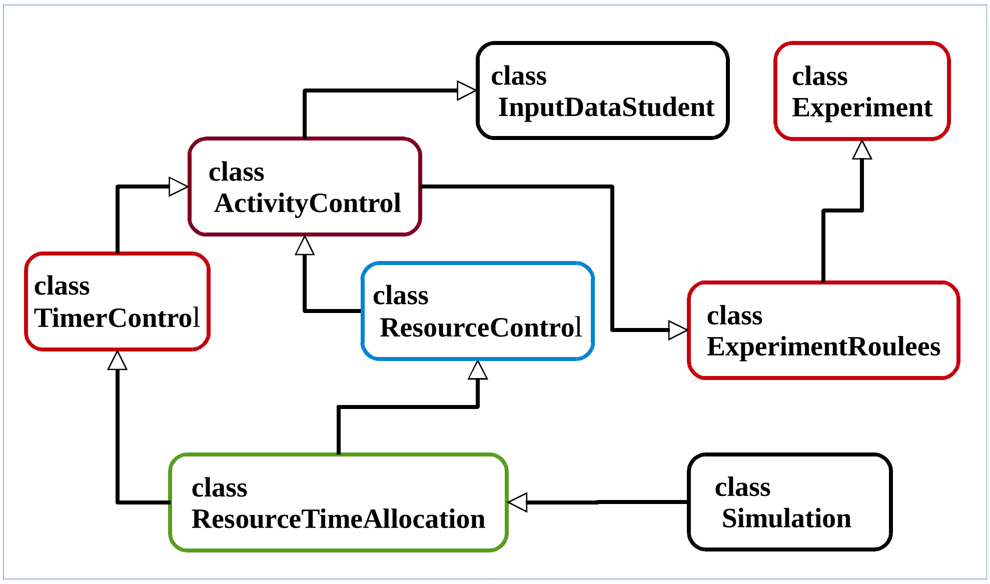

Figure 5. Class hierarchy "Simulation"

Class ”AnalizeExternal" is used to improve the learning process based on the data from the other students. This is achieved through modification of the sets of rules from the database (Figure 6).

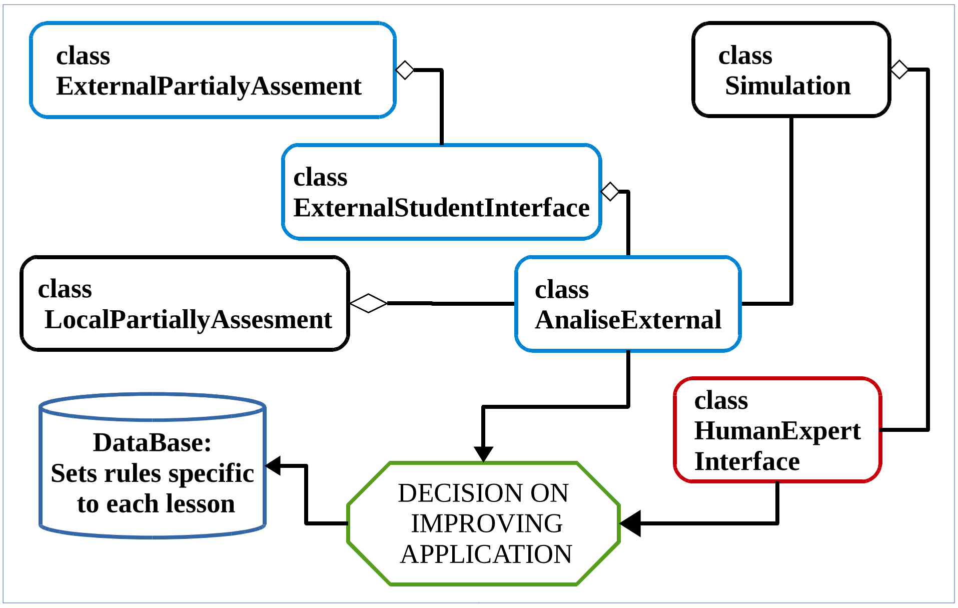

Figure 6. External data analysis

At the time of instantiations of each application will check for updates on the sets of rules.

Conclusion

Developing a learning software which is based on ACO requires the following:

- The existence of delineated steps in the learning process;
- Implement within the group of students, a mechanism for assess communication going through various steps;
- Determine the frequency of use of certain steps (equivalent to determining the intensity of the pheromone);
- Isolation steps that are used rarely or never (pheromone evaporation);
- Improving sets of rules based on the experience of other students.

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Software architecture relational database with the progressive definition of the data structure

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Abstract

There are many situations in which data structure is not fully known when designing application database; outlining their structure, as data is entered into the system. In most cases the volume of data in a database increases progressively. For this reason it is sometimes difficult to determine their structure and especially the constraints between these structures. For the same reason In recent years NoSQL systems have evolved considerably but they have reduced performance when it comes to large volumes of data for complex queries, in this case a relational database system provides a better control of the data. Also current DBMS, allows storage and query data in formats such as JSON or XML. It is possible to start with a NoSQL system and a time to be transformed it into a relational database system, but that time should be fully know data structure. Another possibility would be to start from a relational database with data structures such as JSON or XML type, and they progressively turn into tables and constraints between them. In this paper it is presented a version of the software architecture of databases (PostgreSQL DBMS) that uses initially data structures of type JSON / XML, and that gradually are transformed into tables; transformation which should have minimal impact on the user interface.

Keywords: relational database, NoSQL, XML, JSON

Introduction

NoSQL databases can be classified depending on the model data in models: document (the most common), column, key-value, graph, and multi-model. The current relational DBMS provides mechanisms that can provide the same facilities as NoSQL databases but for small data volumes.

There are a number of data structures that allow taking the data, data structures that are not final. So in the case of XML data type, operation of adding new fields is replaced with adding nodes or attributes.

In order to be printed easily the simplest way to get data may be the HTML format, these data can be taken from various documents and also has the advantage of easy prints. Initial information can exist even in an HTML format, which are then converted into of XML format and finally in tables. Times query data in of XML structures are much higher than for relational structures. In each cell of the table to the field of XML type, is one of XML document. So we have at each parcing for of XML records which greatly reduces search speed.

Software architecture

Software architecture is based on combining XML type or JSON fields with the relational data representation (figure 1).

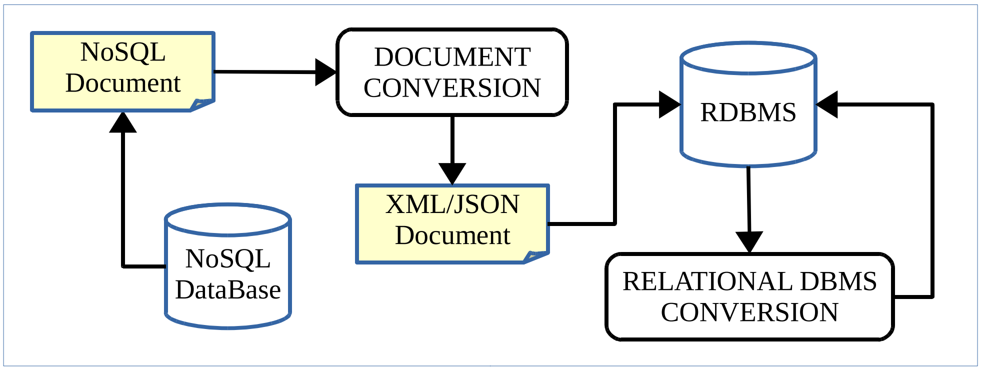

Figure 1. General data flow

In order to achieve the structure is necessary to identify data whose structure may change over time, they will be made available in formats: of XML, JSON or the like. The a priori known data structures can be put into relational tables.

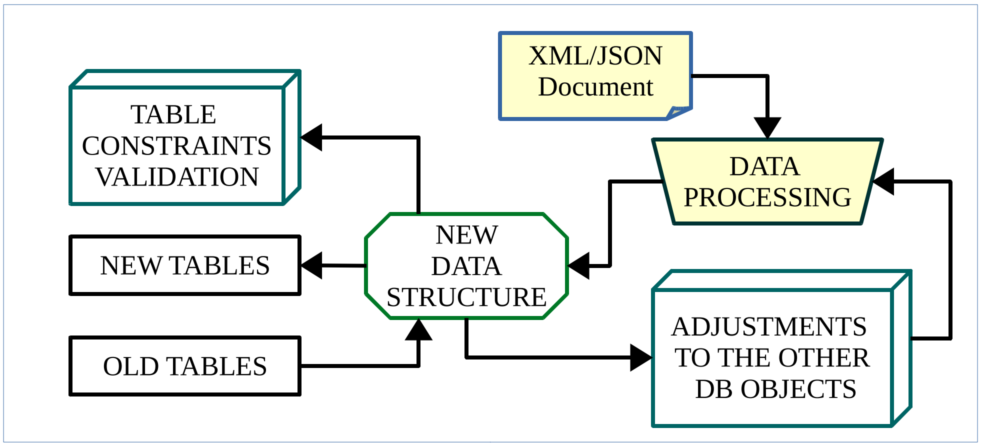

Figure 2. Relational DBMS conversion

The structure of new tables and new objects are established both on the existing structure and based on incoming data into the system (figure2).

Case Study

Tests were performed on a computer with 4GB RAM and processor 1.83 Ghz, OS: Win 8.1. Consider a relational database in the DBMS "PostgreSQL 9.5" .This relational database contains ”entry bordereau” in variable format. The test was performed on a table with 32541 entries containing the same number of documents ”entry bordereau”. These documents are in HTML formats and there are not in purely XHTML format. In the HTML files, there are fields that describe an item on a stock such as: sn (SerialNo) descr (description), status, obs, po, code, mnemonic, reference_, system_, site, supplier and Technology. Table exemplified has the name - ***bdxhtml*** and contains fields: ***nrb*** (”entry bordereau” number) integer type and ***html_*** containing a schedule reception in HTML format.

The transition in table format must be achieved without altering the data. For this, we must accomplish the following steps:

1. The creation an intermediate table that contains both the HTML data field and the final fields as a result of processing HTML table structure. This table also contains intermediate data fields:

- field ***az*** - type varchar / text that takes HTML format text;
- field ***ax*** - of type XML, which takes XML format from the field az;
- field ***bx*** - varchar type [], which takes vectors extracted from the XML data type
- the remaining fields are deducted from the HTML structure;

```
CREATE TABLE tmphtml ( nrb integer, az varchar, ax xml, bx varchar[], sn varchar(51), descr varchar(500), status varchar(52), obs varchar(500), po varchar(53), code varchar(54), mnemonic varchar(55), reference_ varchar(101), system_ varchar(57), site varchar(150), supplier varchar(58), tehnology varchar(59));
```

2. Copy HTML data in the table and bringing it to the same encoding

```
INSERT INTO tmphtml(nrb, html_) SELECT nrb,html_ FROM cso.bdhtml; – – 2.8 sec
```

3. Bringing data to an XHTML consisting, in which case the data consisting of type XML. This can be achieved through the use of replacement overlapping functions specific DBMS's.

```
UPDATE tmphtml SET az=overlay(az::text placing '' FROM position('<b></b><br/><t/>'in az) FOR length('<b></b><br/><t/>')) WHERE position('<b></b><br/><t/>'in az)>1;
UPDATE tmphtml SET az=overlay(az::text placing '' FROM position('TH Technology'in az)+2 FOR length(' Technology')) WHERE position('TH Technology'in az)>1;
UPDATE tmphtml SET az=overlay(az::text placing '' FROM position('TH Supplier'in az)+2 FOR length(' Supplier'));
UPDATE tmphtml SET az=replace(az,'></','>-^-</'); – – 20.8 sec
```

4. The transition of ***text*** in ***XML*** format (az → ax)

```
UPDATE tmphtml SET ax=CAST(az||'</html>' AS xml); – – 48.8 sec
```

For verification can launch the command:

```
SELECT xpath('//TR/TD/text()',ax)::text[] FROM tmphtml – – 35.9 sec
```

5 Extracting data from cell nodes of HTML type into data ***vectors strings***

```
UPDATE tmphtml SET bx = xpath('//TD/text()',ax)::text[];
```

6. The transformation of vectors of strings into columns of a table. This is done by calling the function ***split6u()*** detailed below (1007 sec).

```
CREATE OR REPLACE FUNCTION public.split6u() RETURNS void AS
$BODY$
declare bt2 text[][6]; bt1 text[][12]; dim int; lin int; col int; i int; j int; k int;r record;
begin
DROP TABLE IF EXISTS tmphtml2; CREATE TEMP TABLE tmphtml2(LIKE tmphtml);
for r in select * from tmphtml ORDER BY nrb
LOOP
  SELECT trim(trailing ']' from( SELECT trim(leading '[1:' from (SELECT array_dims(r.bx)))))::int
INTO dim;
  if dim<1 then continue; end if;     col:=0;
  IF r.tipb=1 THEN col:=12; END IF;  IF r.tipb=2 THEN col:=6; END IF;
  IF col=0 THEN continue; END IF;    lin:=dim/col; k:=1;
  for i in 1..lin
    LOOP
    j:=(i-1)*col+1;
    IF r.tipb=1 THEN
      r.sn:=r.bx[j]; r.descr:=r.bx[j+1]; r.status:=r.bx[j+2]; r.obs:=r.bx[j+3]; r.po:=r.bx[j+4];
```

```
    r.code:=r.bx[j+5]; r.mnemonic:=r.bx[j+6]; r.reference_:=r.bx[j+7]; r.system_:=r.bx[j+8];
r.site:=r.bx[j+9]; r.supplier:=r.bx[j+10]; r.tehnology:=r.bx[j+11];
  END IF;
  IF r.tipb=2 THEN
     r.sn:=r.bx[j]; r.descr:=r.bx[j+1]; r.po:=r.bx[j+2];  r.code:=r.bx[j+3];
     r.system_:=r.bx[j+4];r.supplier:=r.bx[j+5];
     r.status:='_'; r.obs:='_'; r.mnemonic:='_'; r.reference_:='_'; r.site:='_';  r.tehnology:='_';
  END IF;
  INSERT INTO tmphtml2( nrb, html_, bx, tipb, sn, descr, status, obs, po, code, mnemonic,
reference_, system_, site, supplier, tehnology)
  VALUES (r.nrb, r.html_ , r.bx, r.tipb, r.sn, r.descr, r.status, r.obs, r.po, r.code, r.mnemonic,
r.reference_, r.system_, r.site, r.supplier, r.tehnology);
  k:=k+1;
  END LOOP;
 END LOOP;
end
$BODY$   LANGUAGE plpgsql VOLATILE  COST 1000;
```

7. Performing other processing, to achieve the relationships between tables.
PostgreSQL provides similar functions for working with JSON structure.

Conclusion

As data accumulates, it outlines the structure of the system and can move gradually from a system - approached philosophy NoSQL, to a relational database system that provides superior performance. Before adding new items might be necessary, destruction and restoration constraints.

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Software development for flexible management of multiple warehouses

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Abstract

In the case of flexible management for multiple warehouses, these may be added or delete just like any item in stock. Each warehouse operations allow input (from another store - transfer operation) or from outside the system. The outputs can be to another warehouse or outside the system. The developed system uses the facilities of the overloading of operators SQL, within PostgreSQL DBMS's. Securing system is at "warehouse" and group operator functions of the application. The application uses a system of tables event based and is implemented in plpgSQL having C ++ interface.

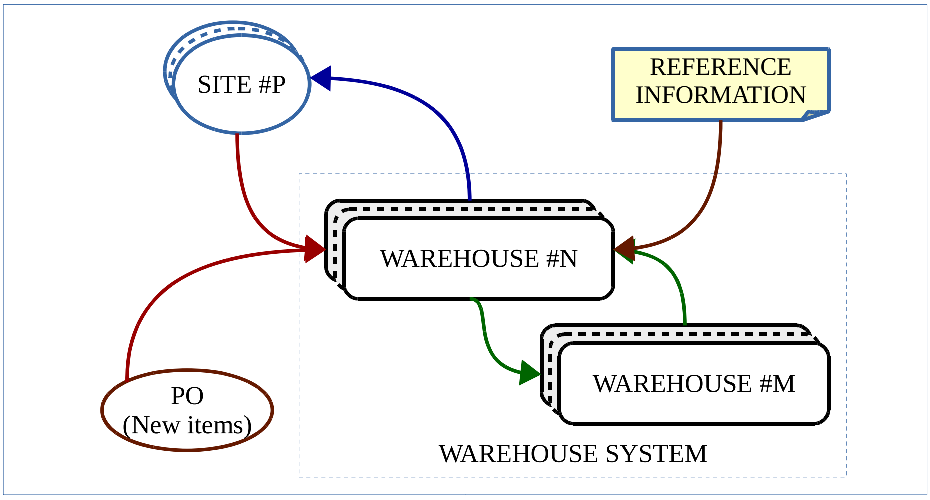
Keywords: software design, multiple warehouse, inventory management

Introduction

The application allows the management of variable number of warehouse; simply adding a new warehouse and access rights so new warehouse will be operational. The application is implemented in PostgreSQL, and uses server-side programming.

Overview About the Design of the Software

Each warehouse can take on new items. Also, each warehouse, changes items with other warehouse - transfer operation. Each warehouse allows retrieving items from sites (item sites that



were delivered by the application sites).

Figure 1. General data flow

The interface is shared on editing tasks and reports. These are customized according to user specific access rights.

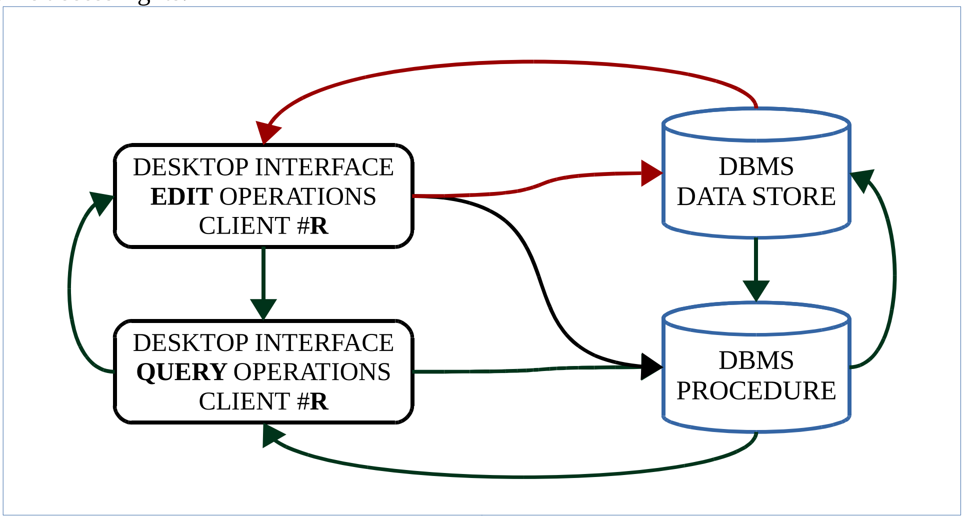


Figure 2. Application interface

Access to data is developed through functions plpgSQL.

Software Architecture

The application is based on a mechanism of the type transition state, and the main tables are:

- CATALOGUE - It contains references for each type of item;
- SNAUX - It contains input information attached to each item;
- STX - It contains a serial number, of any items in stock for each location. Also specify which items are available and which are reserved.
- BDX - It contains information on entry form and delivery form (date, source location, destination location, form type)
- BDAUX - It contains auxiliary information on entry form and delivery form (eg. Document no.)
- TRX - Is the table with the operations: entry / exit / transfer at the item. It contains a serial number, the number of entry form, delivery form number and operation status code reception / delivery (CodeStatus).

The value for ***CodeStatus*** – reception (at item level) are:

- **0** – initial value
- **1** - entry form under constitution
- **2** - entry form validated
- **-2** - entry form deleted

The value for ***CodeStatus*** – delivery (at item level) are:

- **0** – initial value
- **1** - delivery form under constitution
- **2** - delivery form validated
- **3** – delivery form rejected
- **4** – item in transfer (pending)
- -2 - delivery form deleted

FormType field is set to **1** for receptions and is set to **2** for deliveries.

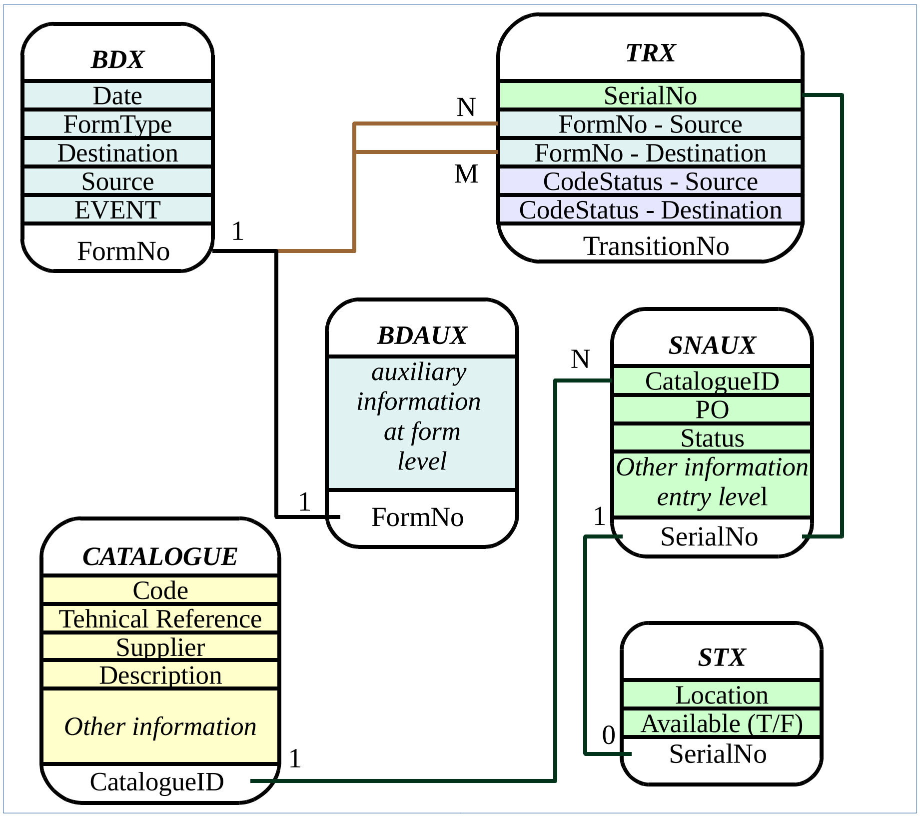


Figure 3. Tables strucure diagram

Items reception operation is performed in several steps and is described in the following diagrams.

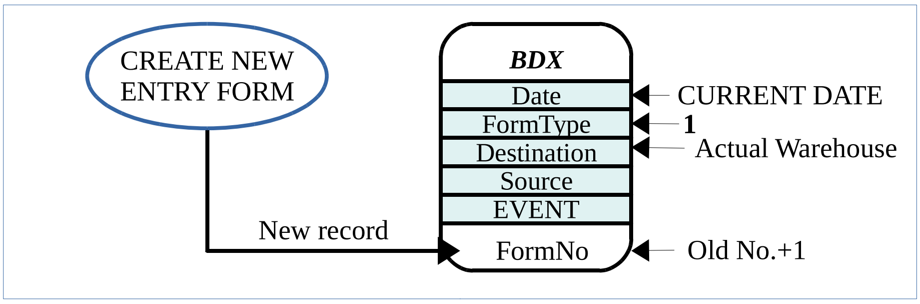


Figure 4. New entry form – step 1

Data source can be a reception from another warehouse (transfer operation), a site (delivered to site throughout the application) or a list of new items for the system (PO provenance).

Both the source and destination are a user-defined data type that allows uniform approach of locations, be it warehouse or site location. In this respect it was necessary SQL overloading operators

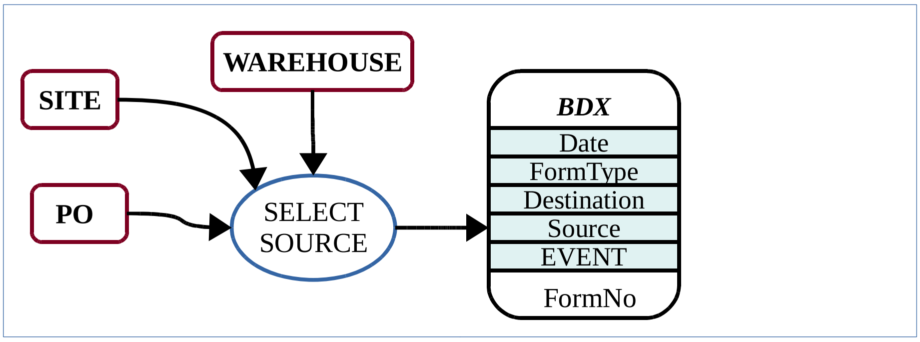


Figure 5. New entry form - step2

After setting the source of the items, the items are selected (if they exist in the system) or edited by the operator (new items). It can also be retrieved via a barcode reader (figure 6).

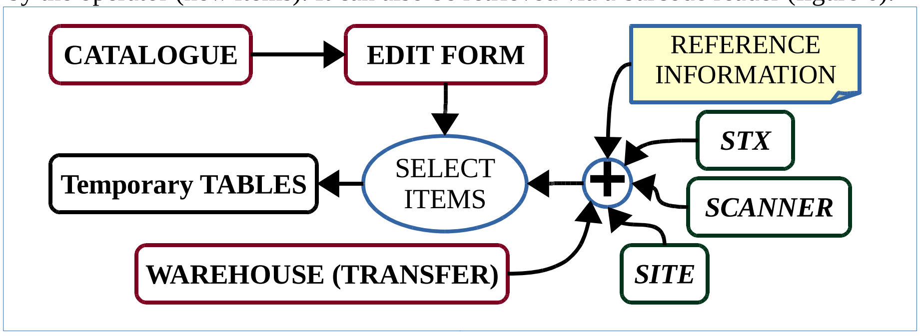


Figure 6. New entry form – step 3

Items are initially placed in temporary tables. By saving the bordereau/form, operator will be able continue to place items on entry form even after closing and reopening the application (figure 7).

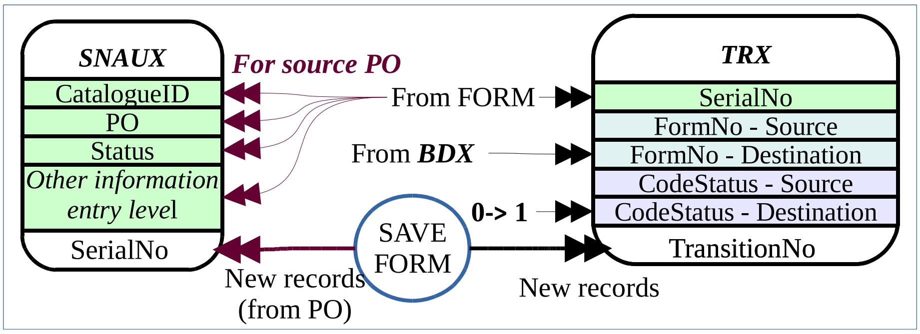


Figure 7. New entry form – step 4

When opening the window for editing receptions, reception forms in pending validation are taken from table TRX (the ***destination*** warehouse must be the current and ***codStatus*** must equal to **1**).

Delete operation transactions will not physically remove a record from the table TRX, but will mark the entry, by a negative value for codStatus.(figure 8)

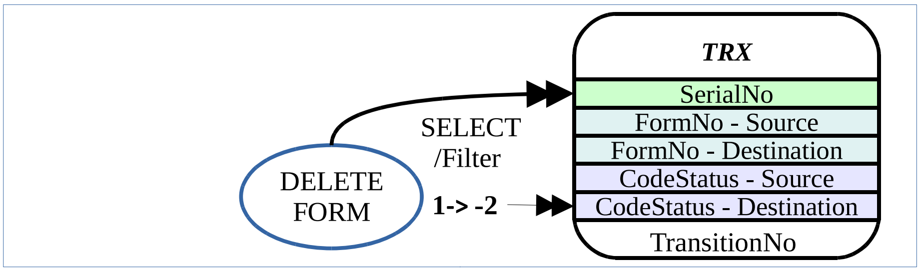


Figure 8. Delete from entry form

Operation validation receipt bordereau/form will have operations specific to the type of source items. Thus, for items coming from transfer operations must delete the previous record of stock (figure 9).

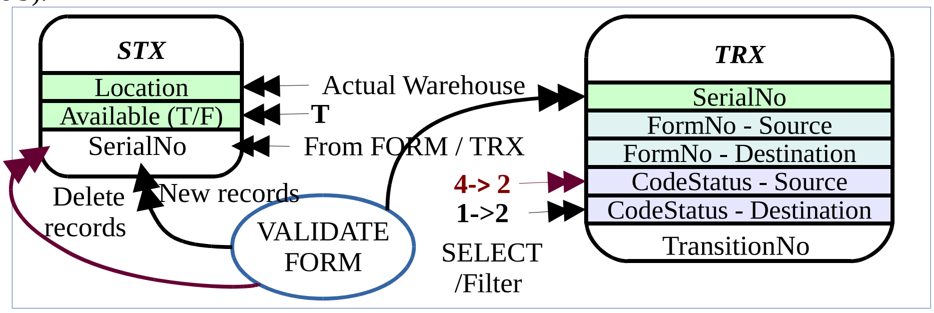


Figure 9. New entry form – step 5

Also creating delivery bordereau will begin to automatically assign delivery bordereau number (OldNo+1).

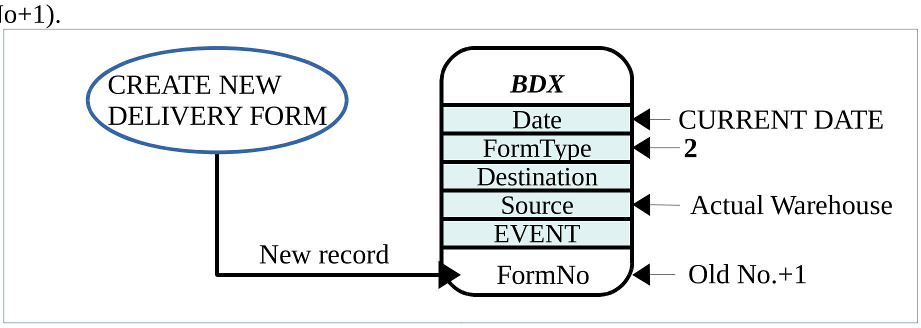


Figure 10. New delivery form – step 1

The destination for delivery form, may be another warehouse or site.

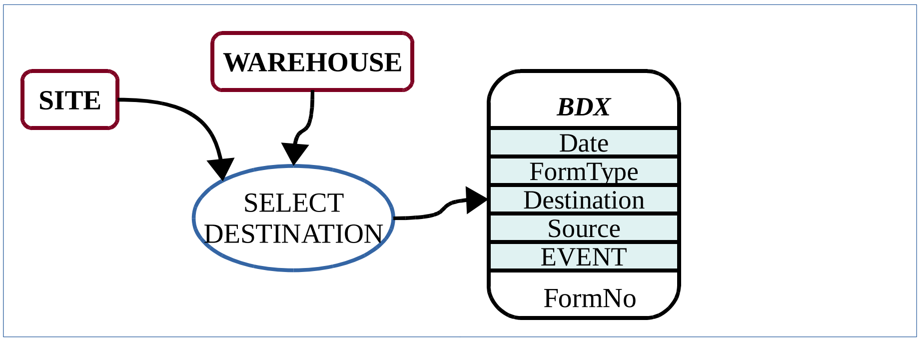


Figure 11. New delivery form – step 2

Depending on the destination (warehouse / site) and references received from other applications (information that must be correlated, while selecting) the selection list is performed. By taking items from the selection list, they are reserved (Available/Disponible STX flag become false).

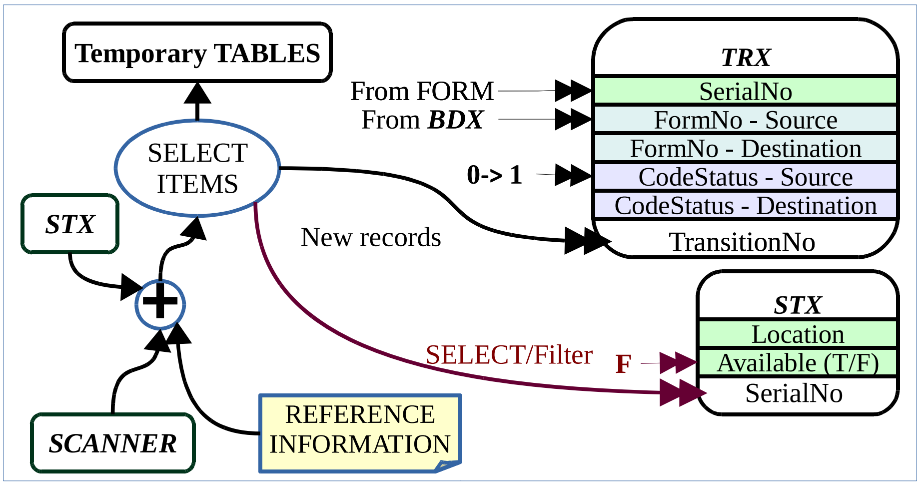


Figure 12. New delivery form – step 3

Deleting delivery form is only done by marking codStatus field, with the value -2. Can be delete both the delivery form, pending completion and those rejected by the recipient.

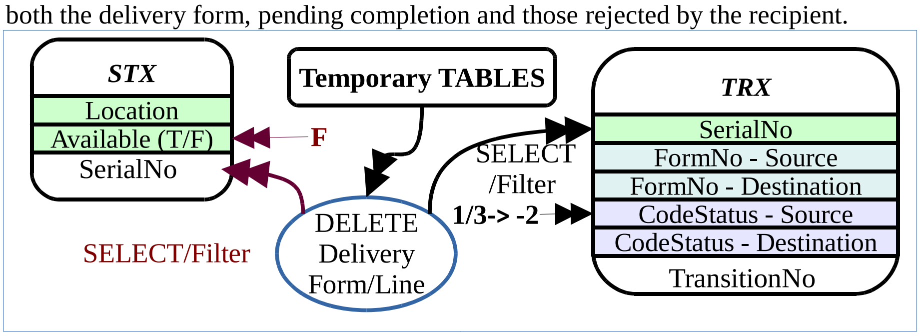


Figure 13. Delete from delivery form

Operation validation delivery form with destination site, involving both marking validation operation in TRX and delete those records from STX.

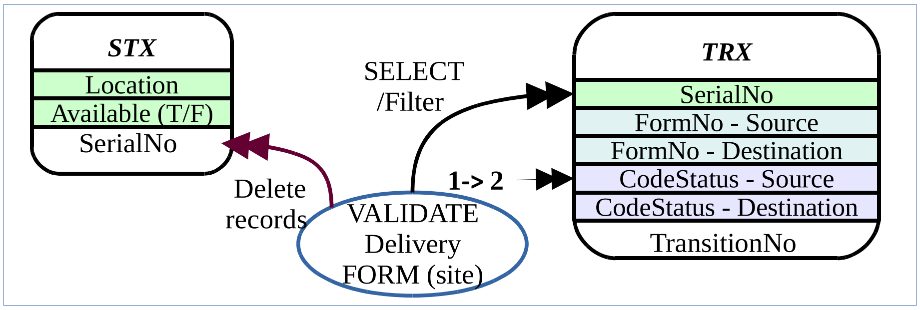


Figure 14. New delivery form – step 4 (to site)

Operation validation form delivery, bound for warehousing, field codStatus only involves updating.

The decrease from the stock items occurs during validation bordereau reception by the recipient.

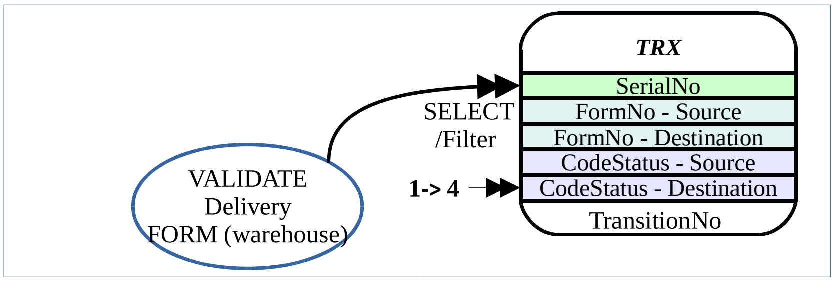


Figure 15. New delivery form – step 4 (to warehouse)

Items rejection is marked only by Item Code field.

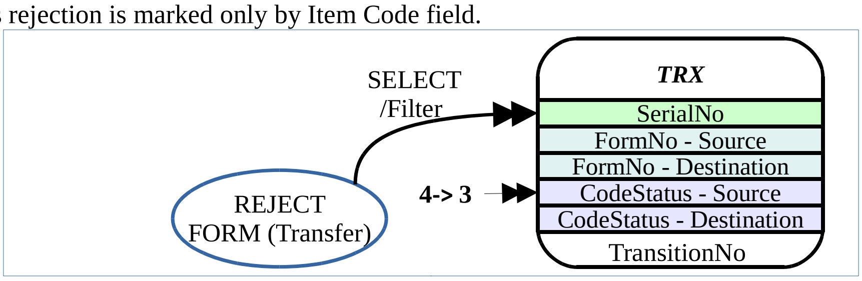


Figure 16. Reject transfer form

Accepting the transfer involves creating a new reception form.

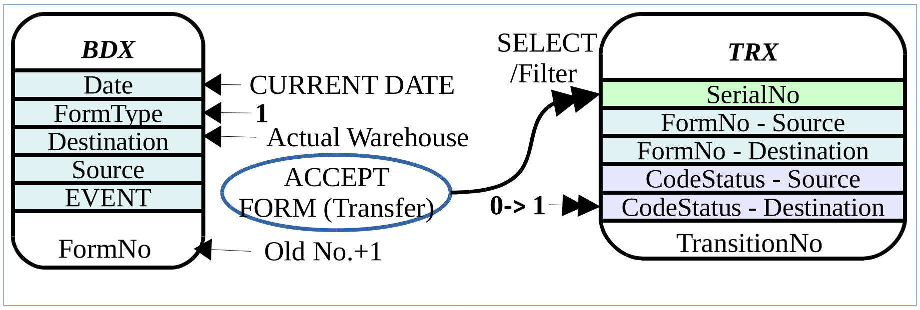


Figure 17. Accept transfer form

Conclusion

I impementat this software to a mobile telephone company. One of the limitations of this system is given the uniqueness of series in the system, thus can not be introduced simple series that can be repeated. The system also has been extended to work with quantities. In this application can automatically generate the series, which have the coding and quantity (code base contains series for tracking and containing the suffix the quantity - amount that can be subtracted on delivery). In this paper I presented only the basic principles of this application.

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S e c t i o n

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An Approach in Teaching Basics of Microprocessors

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Abstract

This paper represent our approach in Faculty of Engineering and Technologies, of teaching students in basics of microprocessors, using virtual software tools, emulating processor's actions.

Keywords: Virtual Learning, Teaching Approach, Basics of Microprocessors

1 Introduction

Used processor, object of this article, is Motorola 6800. Still in use over the world (University of Bolton, Kenyatta University etc.) in learning basics of microprocessors, because a small number of instructions and registers, simplified architecture, it is very convenient for teaching and understanding the basic principles, operations and processes occurring in microprocessors.

The 6800 is an 8 bit, dual accumulator processor with flexible memory addressing modes, was released at about the same time as Intel 8080. He has six programming accessible registers: two 8-bit accumulator, an 8-bit register for the code of conditions, 16-bit index register 16-bit stack pointer and 16-bit program counter. The microprocessor has 72 instructions for arithmetic, logic and control operations. Its clock frequency is 1 MHz and can address 65536 memory cells.

Compared to other processors, it‘s compact and highly orthogonal instruction set makes it easier to program.

The 6800 didn't have I/O instructions and therefore 6800-based systems had to use memory-mapped I/O for input/output capabilities. Motorola 6800 started the big family of 680x microcontrollers and microprocessors, some of which are still produced today.

The 6800/6811 family of processors fueled the early home computing explosion and its derivatives were the processors of choice for many personal computers including Apple, Commodore64, Nintendo etc., and numerous gaming consoles. Its direct descendants are still widely used today as embedded processors.

2 Discussion

The main emulator's name used is “Graphical 6800 Simulator”. The graphical simulator was developed by Mr. S. Scott, an undergraduate student in the Department of Electrical Engineering at the University of Arkansas. Unfortunately it cannot be executed directly on systems newer then Windows XP, because this is 16 bit DOS program. Here comes in handy free tool called DOSBox. With its help we can run this emulator on Windows 7 for example. Current version of DOSBox is 0.74.

Figure 1. Main Screen of Graphical 6800 Simulator Launched in DOSBox 0.74

The best part of this emulator is that trainees can execute assembler program step by step, and visually to follow what and where happens in the registers or memory.

2.1 Description of the panels [1]:

Panel "MPU Control" oversees the major operations available.

Panel "Peripheral selection". Any selection produces a depiction of same at lower right of screen. All peripherals are wired to VIA ports A and B.

Panel "Execution Format". Program execution can be one of three modes. For each, logic values of data and addresses appear highlighted on diagram at lower left of screen, and registers are updated.

Panel "Run Control" - Program execution can proceed or be stopped. Peripheral control allows a key on the hex keypad to be pressed or released, and permits the A/D input voltage to be adjusted.

Panel "Error messages" - Error messages are posted here

Panel "Current instruction" - Here are noted the current instruction mnemonic, the current clock cycle and total for this instruction (e.g. 1/3), and the total clock cycles elapsed from the start of the program.

Students receive task, and they have to write assembler code. Good programming style suggests a good comment on the source code. The following program fragment illustrates this [3]:

```
;==============================
; Sum 1 to 10
;==============================
ten         .equ 10
sum10       clra            ;A = 0
            ldab #ten       ;B = 10
loop1       aba             ;A = A + B
            decb            ;B--
            tstb            ;test (B==0)
            bne  loop1      ;repeat if B!=0
            staa sum ;sum = A
;==============================
; Sum Array values, zero terminated
;==============================
sumarry     ldx #array      ;X = array
            clra            ;A = 0
            clrb            ;B = 0
loop2       adda 0,x ;A += array[0]
            inx             ;next item
            tst  0,x   ;check item
            bne  loop2      ;repeat if B!=0
            staa sum ;sum = A
```

After writing assembler program, students have to translate it manually in HEX code, using table below, which represent machine code, according instruction and type of addressing

Figure 2. Part of Table with HEX Codes of Mnemonic Instructions

ACCUMULATOR AND MEMORY		ADDRESSING MODES: IMMED			DIRECT			INDEX			EXTND			INHER			BOOLEAN/ARITHMETIC OPERATION	COND. CODE REG. 5	4	3	2	1	0
OPERATIONS	MNEMONIC	OP	~	#	OP	~	#	OP	~	#	OP	~	#	OP	~	#	(All register labels refer to contents)	H	I	N	Z	V	C
Add	ADDA	8B	2	2	9B	3	2	AB	5	2	BB	4	3				A + M → A	↕	•	↕	↕	↕	↕
	ADDB	CB	2	2	DB	3	2	EB	5	2	FB	4	3				B + M → B	↕	•	↕	↕	↕	↕
Add Acmltrs	ABA													1B	2	1	A + B → A	↕	•	↕	↕	↕	↕
Add with Carry	ADCA	89	2	2	99	3	2	A9	5	2	B9	4	3				A + M + C → A	↕	•	↕	↕	↕	↕
	ADCB	C9	2	2	D9	3	2	E9	5	2	F9	4	3				B + M + C → B	↕	•	↕	↕	↕	↕
And	ANDA	84	2	2	94	3	2	A4	5	2	B4	4	3				A • M → A	•	•	↕	↕	R	•
	ANDB	C4	2	2	D4	3	2	E4	5	2	F4	4	3				B • M → B	•	•	↕	↕	R	•
Bit Test	BITA	85	2	2	95	3	2	A5	5	2	B5	4	3				A • M	•	•	↕	↕	R	•
	BITB	C5	2	2	D5	3	2	E5	5	2	F5	4	3				B • M	•	•	↕	↕	R	•
Clear	CLR							6F	7	2	7F	6	3				00 → M	•	•	R	S	R	R
	CLRA													4F	2	1	00 → A	•	•	R	S	R	R
	CLRB													5F	2	1	00 → B	•	•	R	S	R	R
Compare	CMPA	81	2	2	91	3	2	A1	5	2	B1	4	3				A − M	•	•	↕	↕	↕	↕
	CMPB	C1	2	2	D1	3	2	E1	5	2	F1	4	3				B − M	•	•	↕	↕	↕	↕
Compare Acmltrs	CBA													11	2	1	A − B	•	•	↕	↕	↕	↕
Complement, 1's	COM							63	7	2	73	6	3				$\bar{M}$ → M	•	•	↕	↕	R	S
	COMA													43	2	1	$\bar{A}$ → A	•	•	↕	↕	R	S
	COMB													53	2	1	$\bar{B}$ → B	•	•	↕	↕	R	S
Complement, 2's (Negate)	NEG							60	7	2	70	6	3				00 − M → M	•	•	↕	↕	1	2
	NEGA													40	2	1	00 − A → A	•	•	↕	↕	1	2
	NEGB													50	2	1	00 − B → B	•	•	↕	↕	1	2
Decimal Adjust, A	DAA													19	2	1	Converts Binary Add. of BCD Characters into BCD Format	•	•	↕	↕	↕	3
Decrement	DEC							6A	7	2	7A	6	3				M − 1 → M	•	•	↕	↕	4	•
	DECA													4A	2	1	A − 1 → A	•	•	↕	↕	4	•
	DECB													5A	2	1	B − 1 → B	•	•	↕	↕	4	•
Exclusive OR	EORA	88	2	2	98	3	2	A8	5	2	B8	4	3				A ⊕ M → A	•	•	↕	↕	R	•
	EORB	C8	2	2	D8	3	2	E8	5	2	F8	4	3				B ⊕ M → B	•	•	↕	↕	R	•
Increment	INC							6C	7	2	7C	6	3				M + 1 → M	•	•	↕	↕	5	•
	INCA													4C	2	1	A + 1 → A	•	•	↕	↕	5	•
	INCB													5C	2	1	B + 1 → B	•	•	↕	↕	5	•

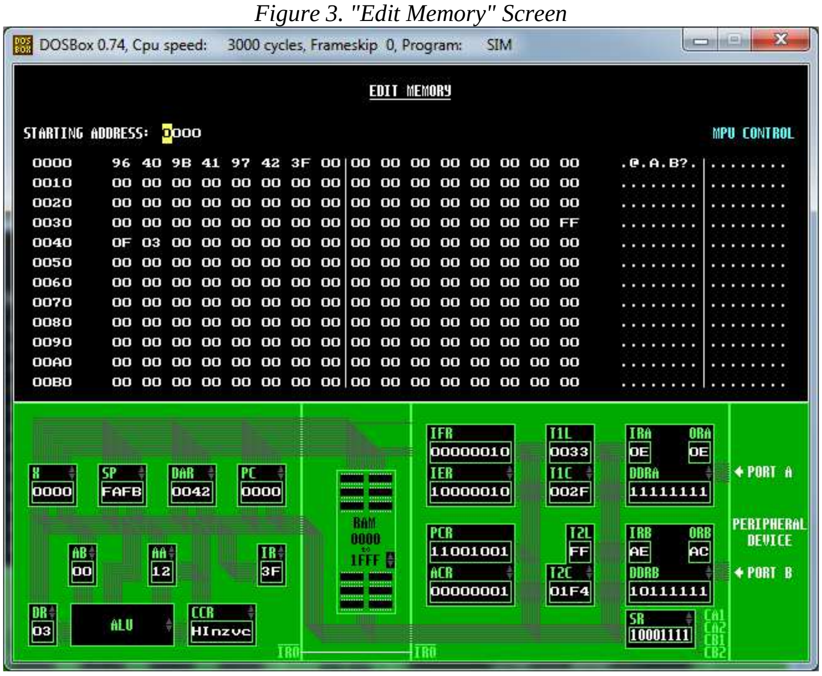
To strengthen the individual work of students the following Table 1 must be filled and…

Table 1. Manual Work Made by Students with the Help of Figure 2

Mnemonic code			Type of used addressing	Hex			B	Mem. address	Comment
Label	Instr.	Operand							
	LDAA	$40	direct	96	40		2	0000	;M->A
	ANDA	#%0000111	immediate	84	0F		2	0002	;A^M->A
	STAA	$41	direct	97	42		2	0004	;A->M
	LDAA	$40	direct	96	40		2	0006	;M->A
	LSRA		internal	44			1	0008	;0->b7
	LSRA		internal	44			1	0009	;0->b7
	LSRA		internal	44			1	000A	;0->b7
	LSRA		internal	44			1	000B	;0->b7
	STAA	$42	direct	97	41		2	000C	;A->M
	SWI		internal	3F			1	000E	

…manually be entered on Edit Memory screen:

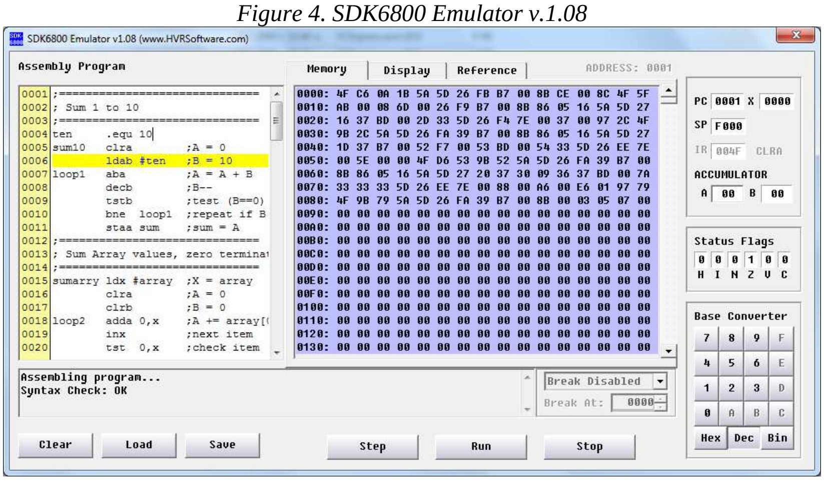
Figure 3. "Edit Memory" Screen



The “Edit Memory” selection produces a view of 128 bytes of memory beginning at a user-specified starting address. Both the hex value and its ASCII translation are displayed. Any visible location can be edited, or an exit made back to the main panel.

In addition there is other free tool called SDK6800 Emulator. Its advantage is that inputted assembly code, if it is written correctly, appears on the left side of the screen like machine code and there is no need not be entered manually. The program also has tools for registers tracking and executing processes step by step:

Figure 4. SDK6800 Emulator v.1.08



6800IDE is a freeware windows based IDE for Motorola's 6800/6811 processor. Designed for educational purposes, it includes an assembler and an emulator for the 6800/6811 with built-in debugging support such as user breakpoints, execution trace, internal register display and a Hex/Bin/Dec number convertor.

3 Conclusion

We decided to use combination of two tools, thus the combination gave us the following advantages: the above mentioned emulators and practices demonstrate to the students how the MPU behaves during the individual clock cycles necessary to complete the instruction, particularly because it is in graphical form. We find that students have some difficulty in understanding complex assembly programs, and again the graphical display of operation eases this obstacle. Best of all, the simulator is easy to learn; no intensive study of a thick manual is required. The students were able to quickly operate all aspects and then spend their time on the device details rather than that of the software.

Acknowledgements

I would like to thank to Associate Professor Veselinka Nedeva from Trakia University, Faculty "Engineering and Technology" in Bulgaria, Yambol, for mentoring during the writing this paper.

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The Study of the Kinematic Parameters of a Vehicle Using the Accelerometer of a Smartphone

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Abstract

The modern approach to the teaching and learning of Physics involves the extensive and creative use of smartphones. Due to the sensors embedded in these mobile devices one can develop a wide range of Physics experiments. One of the sensors that is most extensively used for experimental purposes is the accelerometer. In this study, I aim to highlight and illustrate the didactic importance of this sensor for recording and analysing the movement of a vehicle, in order to establish its motion parameters: acceleration, average speed, distance. The experimental data flow registered by the sensor was recorded with a free mobile application and exported to an Excel spreadsheet for a detailed analysis.

Keywords: Accelerometer, Smartphone, Uniformly accelerated motion, Velocity, Slope, Distance

1 Introduction

The importance of the smart phones in the field of education, particularly in the teaching of Physics, has become acknowledged in the recent years (Countryman, 2014; Kinser, 2015; Monteiro et al, 2015; Monteiro et al, 2015; Kuhn and Vogt, 2013). A series of studies have pointed out that, due to its multiple integrated sensors, the smartphone is an essential tool for a wide variety of Physics experiments, particularly in the field of Mechanics, where the use of the accelerometer plays an important role (Kuhn et al, 2014; Vogt and Kuhn, 2013; Castro-Palacio et al, 2013; Tuset-Sanchis et al, 2015; Chevrier et al, 2013). In this study we focused on the use of the smartphone integrated accelerometer to study the motion of a vehicle (a car) on a horizontal rectilinear road and also while ascending and descending, with a constant acceleration, from the slope of a bridge.

2 Vehicle motion on a horizontal rectilinear road

The first part of the measurements was performed on a horizontal road with an approximate rectilinear length of $500m$.

2.1 Uniformly accelerated motion

On the selected rectilinear part of the road the vehicle accelerated uniformly from 0 to $60\frac{km}{h}$ (Fig.1).

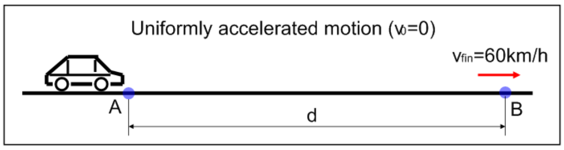

Figure 1. Uniformly accelerated motion

Using the application *Linear Accelerometer*, installed on the smartphone, we recorded the data from the acceleration sensor, saved it in $.csv$ file format and exported it to Excel in order to be processed. The diagram below (Fig.2). illustrates the graphics of variation in time of the values of the acceleration vector components on the three Cartesian axes Ox, Oy and Oz.

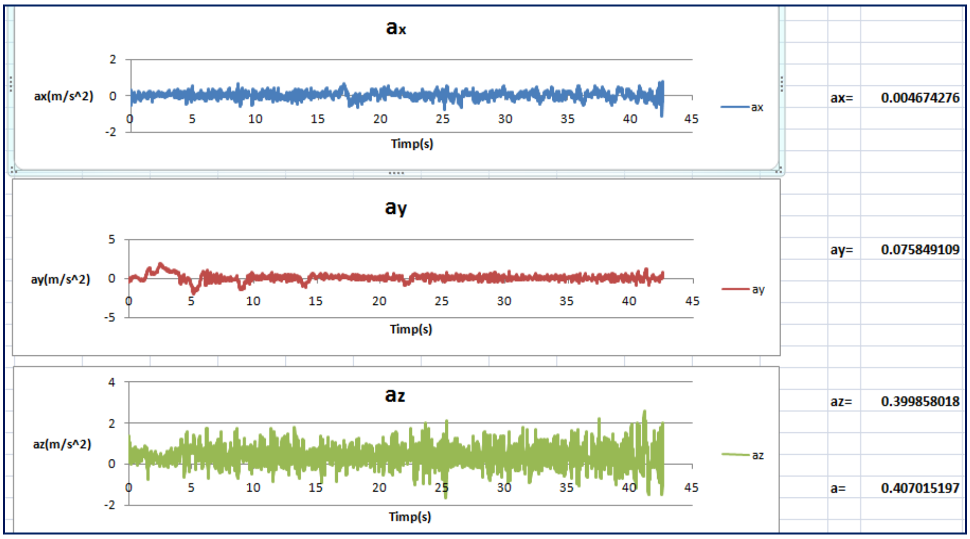

Figure 2. Graphs of recorded acceleration (uniformly accelerated motion)

The time interval for the recording was $t = 42s$. The medium values of the components of the acceleration vector were: $a_x = 0,046\frac{m}{s^2}, a_y = 0,075\frac{m}{s^2}$ and $a_z = 0,40\frac{m}{s^2}$. Given these conditions, the total value of the measured acceleration was:

[1] $$a = \sqrt{a_x^2 + a_y^2 + a_z^2} = 0,407\frac{m}{s^2}$$

The specific distribution of the medium values of the acceleration components is a consequence of the physical structure of the road travelled by the vehicle. The unevenness of the road causes sudden fluctuations of these components.

The distance involved in this experiment was determined with the law of space, with the initial velocity $v_0 = 0$:

[2] $$d = a \cdot \frac{t^2}{2} = 0,407\frac{m}{s^2} \cdot \frac{42s^2}{2} \cong 359m.$$

The velocity reached by the vehicle calculated using the measured values for acceleration and time was:

[3] $$v = v_0 + a \cdot t = 0,407\frac{m}{s^2} \cdot 42s = 17,09\frac{m}{s} = 61,53\frac{km}{h}(v_0 = 0).$$

The relative measurement error between the calculated value of velocity and the value displayed by the speedometer of the vehicle was $\varepsilon = \frac{61,53-60}{60} = 2,55\%$. This is a good result which demonstrates the quality of the recordings performed with the accelerometer.

2.2 Uniformly decelerated motion

We also determined the acceleration of a vehicle for an uniformly decelerated motion on a rectilinear road (Fig.3).

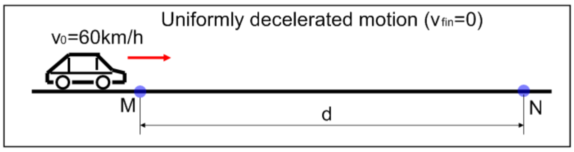

Figure 3. Uniformly decelerated motion

The vehicle in which the mobile phone was placed, having the *Linear Accelerometer* application on, gradually reduced its speed from $60\frac{km}{h}$ to zero. The graphic below (Fig.4) illustrates the variations in time of the values of the acceleration components on the three Cartesian axes.

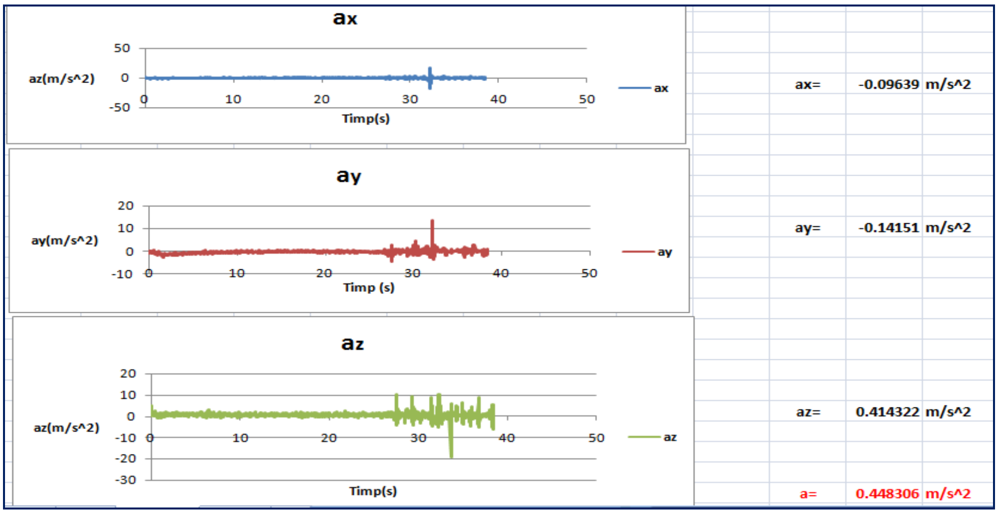

Figure 4. Measurement graphics (uniformly decelerated motion)

The time interval for the recording was $t = 38s$. The sign minus present in the medium values of a_x and a_y indicates the existence of a decelerated motion $(a = \frac{dv}{dt} < 0)$. The absolute value of the total acceleration was $a = 0,448\frac{m}{s^2}$. The presence of fluctuations in the values of the acceleration components in the last ten seconds of the motion (the interval $27 \div 38s$) was triggered by the structural defects in the surface of the road.

The initial velocity of the vehicle was determined based on the law of velocity with a null final velocity. Its calculated value was:

[4] $$v_0 = a \cdot t = 0,448\frac{m}{s^2} \cdot 38s = 17,02\frac{m}{s} = 61,28\frac{km}{h}.$$

The relative measurement error was $\varepsilon = \frac{61,28-60}{60} = 2,13\%$. The distance covered by the vehicle until it stopped was calculated using the Galileo's equation, with a null final velocity:

[5] $$d = \frac{v_0^2}{2 \cdot a} = \frac{(17,02\frac{m}{s})^2}{2 \cdot 0,448\frac{m}{s^2}} \cong 323m.$$

The comparative analysis of the acceleration graphics a_x, a_y and a_z for the two types of studied motion indicated the presence of local value fluctuations that were more evident in the uniformly accelerated motion compared to the uniformly decelerated motion.

3 Vehicle motion with constant acceleration on the slope of a bridge

We determined the accelerations a_x, a_y and a_z for the ascending and descending motion of a vehicle on the slope of a bridge (Fig.5).

Figure 5. The bridge travelled by the vehicle

3.1 Ascending motion

During the first phase of the experiment, we determined the components of accelerations for the upward motion of a vehicle on the slope of a bridge (Fig.6).

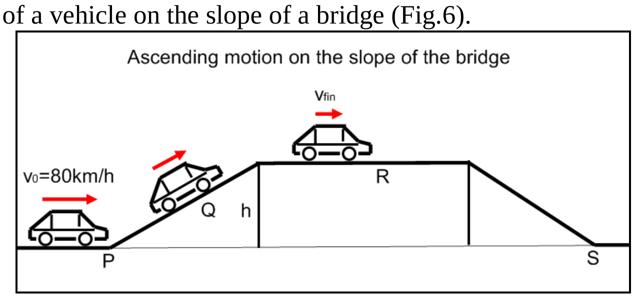

Figure 6. Car ascending on the slope of the bridge

When the vehicle travelled up the bridge, the following graphics were obtained (Fig.7):

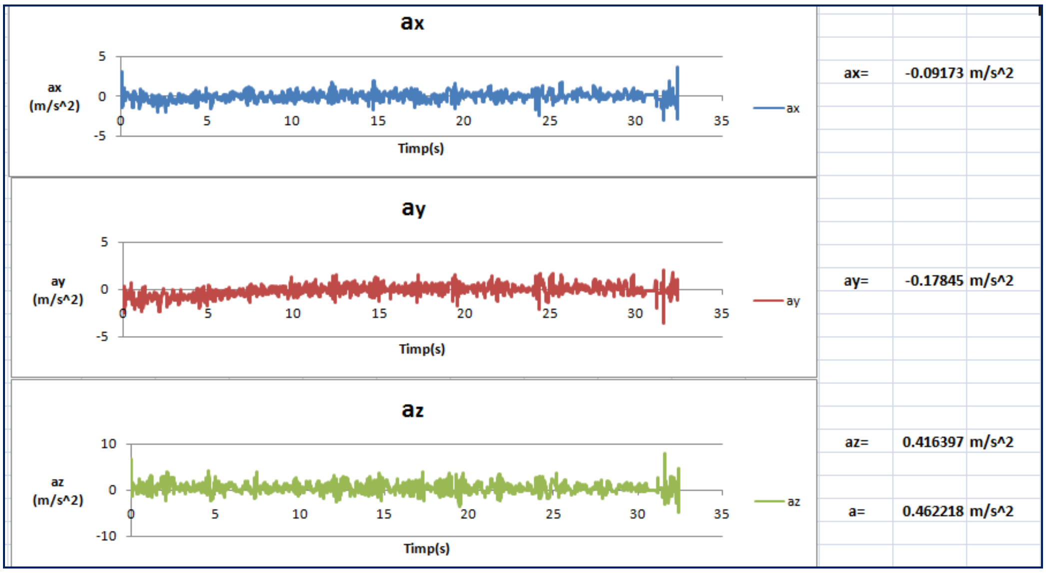

Figure 7. Measurement graphics (accelerations recorded on bridge ascension)

The initial velocity of the car, indicated by its speedometer when starting the ascension on the bridge was $v_0 = 80\dfrac{km}{h}$. At the top end of the slope, the speed indicated by the speedometer was $30\dfrac{km}{h}$. The time interval for the recording was $t = 32s$. We compared this value to the one calculated using the law of velocity for the uniformly decelerated motion: $v = v_0 - a \cdot t$. The acceleration of the car determined from the graphics was $a = 0,46\dfrac{m}{s^2}$. We obtained the results:

[6] $$v = 80\frac{km}{h} - 0,46\frac{m}{s^2} \cdot 32s = 27,6\frac{km}{h}.$$

The value calculated experimentally has a relative error of $\varepsilon = \dfrac{30 - 27,6}{30} = 8\%$ compared to the value indicated by the speedometer of the car ($30\dfrac{km}{h}$), which illustrates a good precision of the data recorded with the application *Linear Accelerometer*. The distance travelled by the vehicle during the recordings was:

[7] $$d = v_0 \cdot t - a \cdot \frac{t^2}{2} = 80\frac{km}{h} \cdot 32s - 0,46\frac{m}{s^2} \cdot \frac{(32s)^2}{2} \cong 481m.$$

3.2 Descending motion

We performed another measurement when the car descended from the slope of the bridge (Fig.8) and had an uniformly accelerated motion with the initial velocity: $v_0 = 30\frac{km}{h}$. The data recording interval was $t = 19s$.

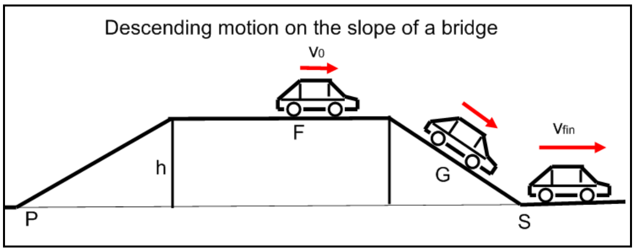

Figure 8. Car descending on the slope of the bridge

The diagram with the measured acceleration graphics is illustrated below (Fig.9).

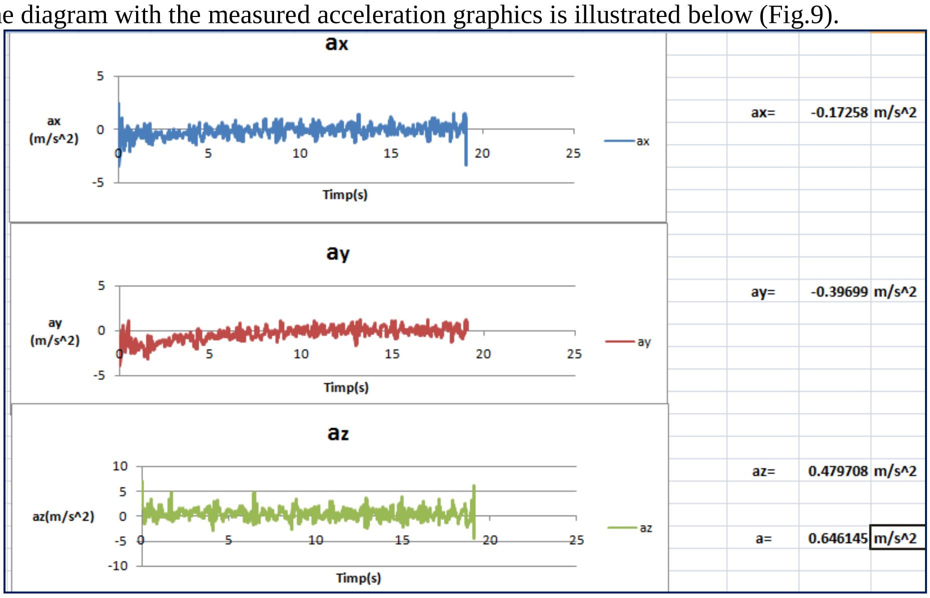

Figure 9. Measurement graphics (accelerations recorded on bridge descending)

The measured acceleration had the value $a = 0,646\frac{m}{s^2}$. The velocity reached by the vehicle at the end of the time interval for the recording was

[8] $$v = v_0 + a \cdot t = 30\frac{km}{h} + 0,646\frac{m}{s^2} \cdot 19s = 74,43\frac{km}{h}.$$

We compared this value with the one indicated by the speedometer of the car $v = 80\frac{km}{h}$. The relative error was $\varepsilon = 1 - \frac{74,43}{80} = 6,9\%$, a value which is within the experimental limits. At the same time, the distance travelled by the vehicle in the time interval $t = 19s$ was calculated using the space law:

[9] $$d = v_0 \cdot t + a \cdot \frac{t^2}{2} = 8,4\frac{m}{s} \cdot 19s + 0,646\frac{m}{s^2} \cdot \frac{(19s)^2}{2} \cong 283m$$

The map of the road travelled by the vehicle was drawn using Google Maps (Fig.10). This way the total length of the road travelled by the car was determined $D = 1,22km$. The measurements were performed when the car travelled on this road for a distance $\Delta d = 481m + 283m = 764m$, ascending and descending from the bridge.

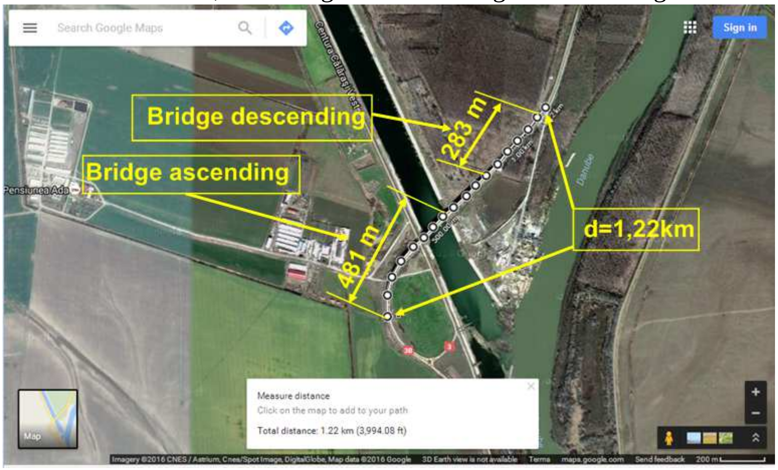

Figure 10. Map of road travelled by the car (bridge slope)

4 Conclusions

The use of the accelerometer for the study of the kinematic parameters of a vehicle is an engaging process for nowadays' students, who establish a link between their portable device (smartphone) and its potential role in learning about and exploring physical phenomena. This study has shown that the acceleration sensor integrated in a smartphone is reliable and has a high degree of accuracy when measuring the acceleration of a vehicle. Therefore, it is expected that in the following years more Physics teachers will choose to integrate into their classes experiments based on the use of the accelerometer. The potential of a smartphone's sensors for education related purposes should be further explored and exploited by the science teachers.

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The Use of Mobile Phones for the Study of Periodical Movements

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Abstract

Nowadays, mobile devices hold an extraordinary didactic potential which is just beginning to be explored and grasped by the Physics teachers community. The high-accuracy sensors that mobile phones are equipped with enable one to integrate these mobile devices in the experimental area of Physics lessons, as analysis and measurement instruments. This study is designed to demonstrate how the accelerometer of a mobile phone can be used to record and study the periodical movements, such as the uniform circular motion and the harmonic oscillations. The quantitative and qualitative analysis of the data recorded by the acceleration sensor is facilitated by a mobile application which provides a real-time visualisation of the value component of acceleration.

Keywords: Smartphone, Accelerometer, Harmonic oscillations, Pendulum

1 Introduction

Smart phones are not only communication and entertainment portable devices, but also valuable tools that engage students in learning and motivate them to investigate Physics related concepts (Goad, 2012). The acceleration sensor integrated in the smartphones has a remarkable importance for the modern approach to the teaching of Physics, particularly in the field of Mechanics (Vogt and Kuhn 2012; Kuhn and Vogt, 2013; Vogt and Kuhn, 2014; Gonzales et al, 2014). This sensor enables the students to trace, with a fairly accurate degree of precision, the evolution of the values of the Cartesian components of a body's acceleration in time. That is why the use of this sensor is adequate for a broad range of dynamically oriented Mechanics experiments, such as the ones involving periodical movements. Several studies have shown the sensor's application for the study of circular motions (Ballester et al, 2014; Castro-Palcio et al, 2014; Chevrier et al, 2013; Viridi et al, 2013; Vogt and Kuhn, 2013) which the students generally find more difficult to understand when the teaching takes place on a purely theoretical level (Martinez, 2014). This study however focuses on the way the accelerometer can be used to quantitatively and qualitatively study the periodical movements of a gravitational pendulum.

2 Pendulum experiments

In this study we aim to illustrate data acquisition experiments performed both in the Physics Laboratory, as well as outdoors. In both cases we determined, based on the analysis of the recorded acceleration graphic, the following parameters of the oscillation of the body suspended by the wire: the oscillation period T, the angular frequency ω, the frequency ν, the angular amplitude $\theta_{\max}$, the maximum speed $v_{\max}$, the maximum kinetic energy $E_{c\max}$ and the maximum potential energy $E_{p\max}$. Moreover, taking from the graphic the maximum value of the recorded acceleration $a_{\max}$ we performed determinations of the value of the gravitational acceleration g, when knowing the length l of the pendulum. The value obtained for g was compared to the standard value used to establish the level of experimental precision given by the acceleration sensor.

2.1 Laboratory Experiments

The gravitational pendulum used in the Physics laboratory is illustrated in Fig.1. It was made from a cylindrical homogenous object (a can) which had a suspension wire at the top end and a rectangular frame for fitting the smartphone on its bottom end. The mass of the suspended body, including the mobile phone, was $m = 0,58kg$ and, from the total length of the wire $L = 0,5m$ the value employed was $l = 0,44m$ (the difference in length was used for fastening the ends of the wire).

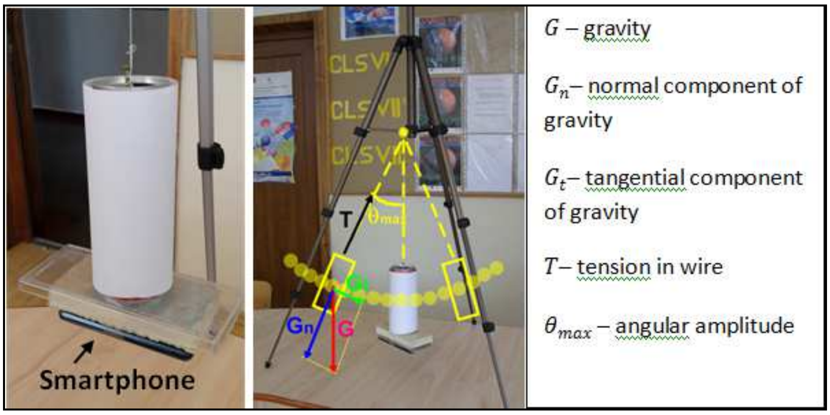

Figure 1. **Gravitational pendulum experiment in the Physics laboratory**

The suspended body was taken out from its equilibrium position under a θ angle and left to oscillate relative to the vertical symmetry axis of the experimental setup. The angular amplitude of the oscillations was gradually reduced, until a harmonic oscillation regime specific for small angles was reached ($5 \div 6$ degrees).

The movement of the pendulum took place on a yOz level, as the phone's yOz accelerometer axes were situated in this plane. Due to the reduced angular amplitude of the oscillations, the most significant contribution to the tangential acceleration was brought by the component a_y.We selected, from the recording performed with the application *Linear Accelerometer* installed on the phone, the area which corresponds to the harmonic oscillation regime (Fig.2).

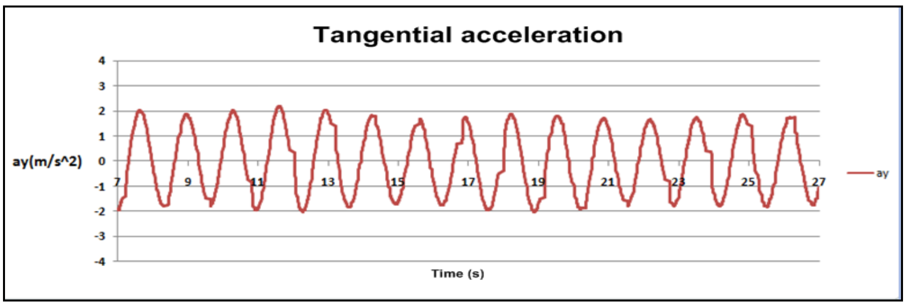

Figure 2. Graphic of tangential acceleration component a_y

We need to mention the fact that the application *Linear Accelerometer* stores the recorded data into a $.csv$ format in order for it to be processed in Excel.The disturbance factors during the experiment (vibrations from the acoustic spectrum, typical for a school laboratory during classes) caused slight local distortions of the tangential acceleration a_{tg} graph variation with time t. Still, this aspect did not have a major influence on the value of the measured parameters.

During the time interval selected $\Delta t\ (7 \div 27s)$ there are $N = 15$ oscillations. Therefore, their oscillation period is $T = \dfrac{\Delta t}{N} = \dfrac{20s}{15} = 1,33s$. The angular frequency ω of these oscillations has the value $\omega = \dfrac{2 \cdot \pi}{T} = 4,71\dfrac{rad}{s}$ and their ν frequency is $\nu = \dfrac{1}{T} = 0,75Hz$. From the relationship $\omega^2 = \dfrac{g}{l}$ we calculated that:

[1] $$g = l \cdot \omega^2 = 0,44m \cdot (4,71s^{-1})^2 = 9,76\frac{m}{s^2}.$$

This value is close to the known value $9,81\dfrac{m}{s^2}$ (the difference in value is within the 1% limit).

From the graphic we can notice the fact that the amplitude of the tangential acceleration has slight fluctuations around the value of $2\dfrac{m}{s^2}$. By averaging its maxium values from the selected time interval we calculated $a_{tg} = 1,72\dfrac{m}{s^2}$. Form the relationship $a_{tg} = g \cdot \sin\theta_{\max} \cong g \cdot \theta_{\max}$ we determined that the angular amplitude specific for small oscillations is $\theta_{\max} = \dfrac{a_{tg}}{g} = \dfrac{1,72\frac{m}{s^2}}{9,76\frac{m}{s^2}} = 0,17rad$. This value corresponds to an angle $\theta_{\max} = \arcsin(0,17) = 9,78$ degrees, which is within the small oscillations range where the harmonic oscillation regime of the pendulum is predominant.

The length of the angular sector associated with this angular amplitude has the value $s = l \cdot \sin\theta_{\max} = 0,44m \cdot 0,17 = 0,075m = 7,5cm$. The maximum speed attained, deducted from the law of the conservation of mechanical energy applied in the case of small oscillation, was:

[2] $$v_{\max} = \sqrt{2 \cdot g \cdot l \cdot (1 - \cos\theta_{\max})} = 0,358\frac{m}{s} = 35,8\frac{cm}{s}.$$

The associated kinetic energy had the value:

[3] $$E_{c\max} = \frac{m \cdot v_{\max}{}^2}{2} = \frac{0,58kg \cdot (0,358\frac{m}{s})^2}{2} = 0,037J.$$

Due to the fact that the studied system oscillated in a harmonic regime, it is placed in a conservative forces field, so this value of kinetic energy is to be found in the value of the maximum potential energy of the studied gravitational pendulum.

2.2 Outdoor Experiments

The experiments for analysing the periodical motion using a gravitational pendulum continued outside the Physics laboratory, on the school sports field. The experimental device was modified so that the movement could be stabilized in order to avoid the errors produced at the interference of the oscillating motion with mechanical vibrations from the surrounding environment.

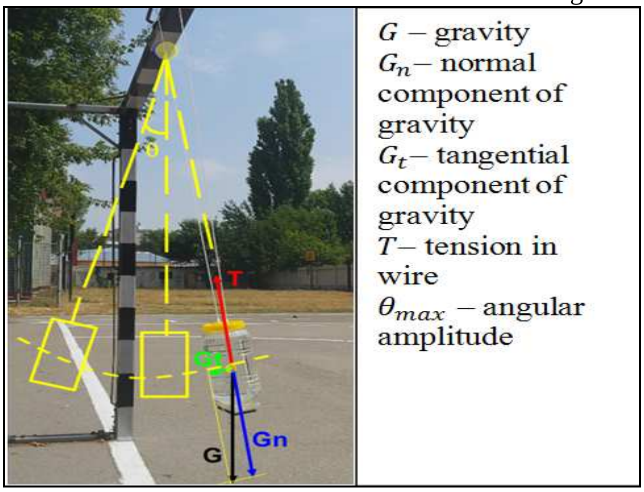

Figure 3. Gravity pendulum - experimental setup outdoors (1)

Using a sealed cylindrical plastic container filled with water we constructed a bifilar pendulum with the effective length of $l = 1,55m$. The mass of the suspended body was $m = 3,1kg$. The body was suspended from the horizontal bar of a handball goal present on the school sports field. The mobile phone was placed at the bottom of this body using a plexiglass interface (Fig.3). After performing the horizontal alignment tests of the device using a balance level, we started the experimental determinations. From the large area of acceleration recordings taken with the smartphone, we selected for analysis the ones which correspond to the harmonic oscillation regime, as Fig.4 illustrates.

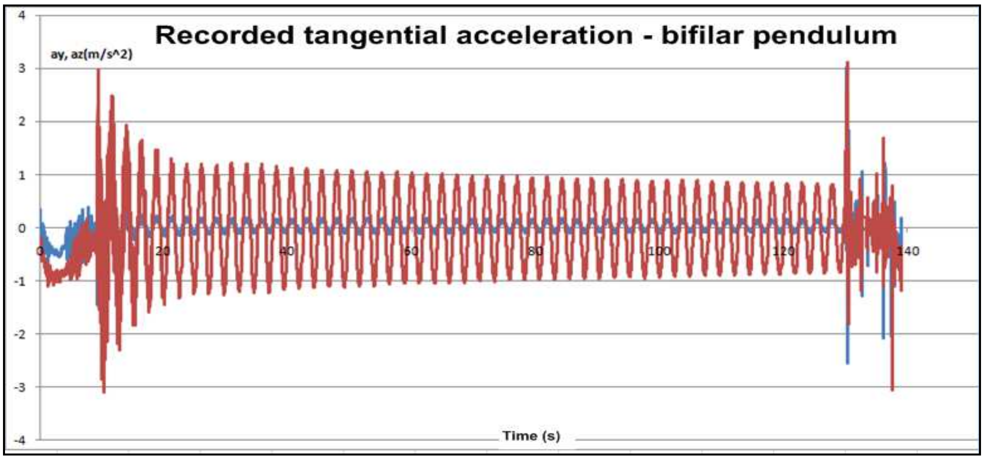

Figure 4. Graphic of recorded tangential acceleration (bifilar pendulum)

As we can notice from the diagram, the a_y component weighs the most in the tangential acceleration of the pendulum. The time interval of the recording which best approximates the harmonic oscillation regime is $\Delta t = 20s$, situated between $t_1 = 80s$ and $t_2 = 100s$ (Fig.5).

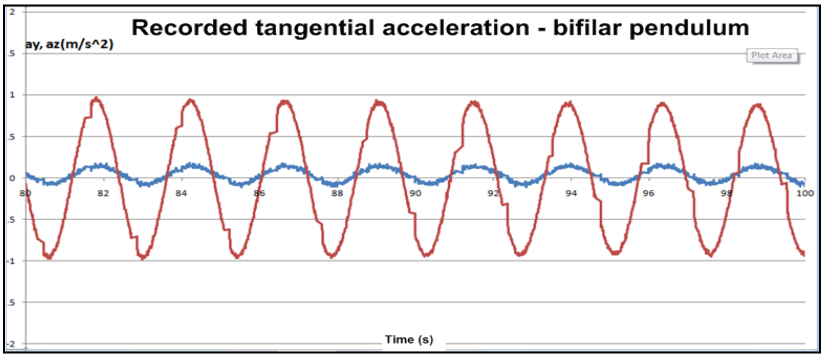

Figure 5. Graphic of recorded tangential acceleration (harmonic oscillation)

By cancelling the a_z component of the tangential acceleration due to its insignificant value, the graphic has the following form: (Fig.6).

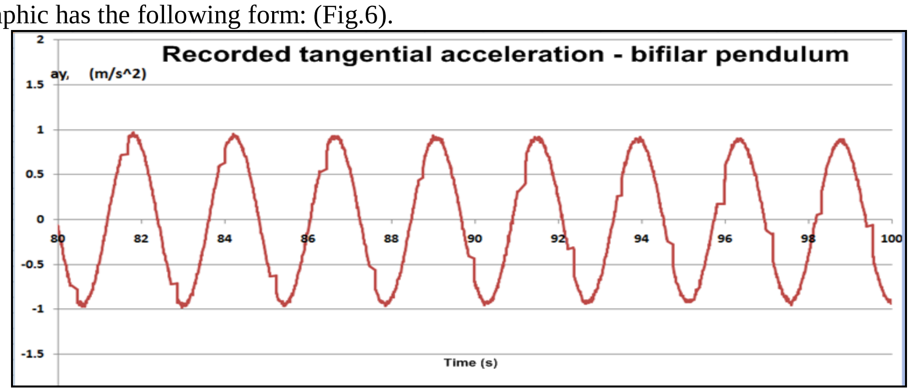

Figure 6. Graphic of recorded tangential acceleration (a_y component)

The number of oscillations present in this time interval is $N = 8$ which leads to the conclusion that $T = \frac{20s}{8} = 2,5s$. The average of the maximum oscillation values of the tangential acceleration was $a_{tg\max} = 0,927\frac{m}{s^2}$, given the fact that the fluctuation between the first and the last peak from the analysed time interval was $8,2\%$.

The values of the determined physical quantities are illustrated in the table below (Table 1).

Table 1. *Values of physical quantities*

Physical quantity	Frequency $\nu(Hz)$	Angular frequency $\omega(\frac{rad}{s})$	$g(\frac{m}{s^2})$	Variation of g (%)	$\theta_{\max}$ (deg.)	$v_{\max}(\frac{m}{s})$	Length of travelled sector (m)	$E_{c\max} = E_{p\max}(J)$
Determined value	0.4	2.512	9.78	0.3	5.4	0.366	0.29	0.207

The determination of the physical quantities from Table 1 was also performed during an outdoors experiment in an amusement park for children. We used the swings present on the site as pendula and the data recording proved to have both a fun and a scientific factor (Fig.7).

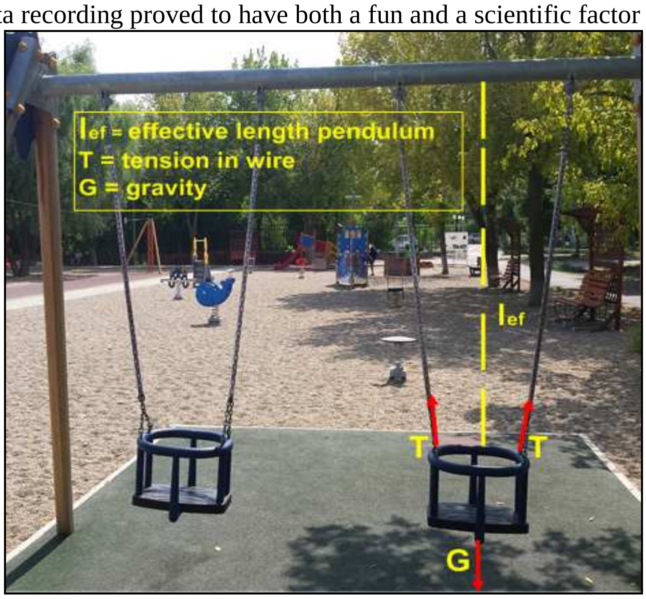

Figure 7. **Gravity pendulum - experimental setup outdoors (2)**

A sample of the acquired experimental data is illustrated in Fig.8.

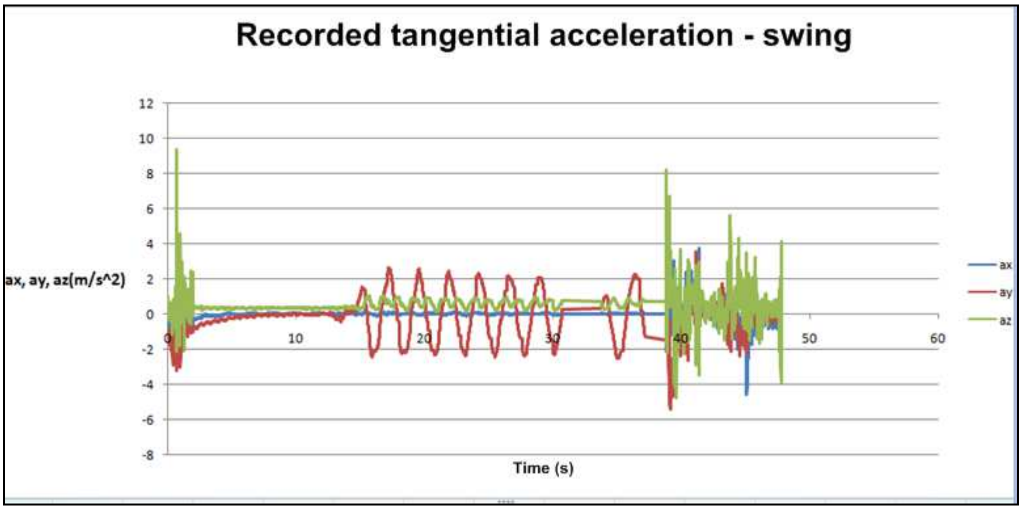

Figure 8. Graphic of recorded tangential acceleration (swing)

The fluctuations present in the beginning and at the end of the recording are caused by the mechanical disturbances induced by the person operating the application *Linear Accelerometer* installed on the smart phone. The area of interest for analysis in the graphic is to be found in the interval $15 \div 30s$. In this region one can observe periodic phenomena of a harmonic type. The a_x component of acceleration does not contribute quantitatively to the total value of the tangential acceleration a_{tg} .

The quantitative difference between the maximum values of a_y and a_z is the consequence of the oscillations having a small angular amplitude.

Using the information from the graphic in Fig.8 we determined the value of g starting from $g = l \cdot \omega^2$. The value of ω was determined using the relationship $\omega = \frac{2 \cdot \pi}{T} = \frac{2 \cdot \pi}{\frac{t}{N}} = \frac{6,28}{\frac{15s}{6}} = 2,512 \frac{rad}{s}$. The measured value of l was estimated at $l = 1,55m$. Therefore, $g = l \cdot \omega^2 = 1,55m \cdot (2,512s^{-1})^2 = 9,78 \frac{m}{s^2}$.

The fact that the value is close to the standard one of $9,81 \frac{m}{s^2}$ indicates that the accelerometer has a good precision in recording data.

3 Conclusions

This study has shown the reliability of the accelerometer when studying the oscillating motion of a gravitational pendulum, both in laboratory conditions and outdoors. The successful experimental results reflect the importance of this sensor for the precise and quickly attainable measurements of a body's acceleration while oscillating.

The graphics that accurately trace the evolution in time of the Cartesian components of the pendulum acceleration are very important elements that students can use to analyse harmonic oscillations. Based on the data stemming from these graphics, the students are able to calculate the values of the physical quantities involved: period, frequency, angular amplitude, velocity, energy etc.

All in all, the smart phone should be viewed as a valuable multi-sensor tool which can be used to investigate a wide range of physical phenomena and which can be part of many creative Physics experiments. The successful integration of this portable device into the teaching process can greatly enhance the qualitative aspect of learning and stimulate the students' motivation for the study of science in general and of Physics in particular.

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A study on the efficiency of feedback in the learning process

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Abstract

Feedback is acknowledged as an important element in the process of didactic communication as it adjusts and, obviously, ensures efficient conditions of the learning process. Specialists state that its presence in didactic communication leads to the increase of the efficiency of the message /of the learning act, it provides a secure climate for both teacher (who knows how his/her message is received) and students (who can control their act of learning based on the reference frame provided by the teacher), it improves the interpersonal relationships among those involved in the didactic act. Its absence reduces learning to an inefficient, frustrating process for both partners in education.

Feedback can be analysed from both directions: feedback given by the student to the teacher and feedback provided by the teacher for the student. It is important for the students to receive information about the quality of their learning tasks. Its lack will make them feel insecure, unsatisfied and unmotivated. Under the circumstances teacher's feedback is a stimulus for the students to keep on engaging in the various learning and intercommunication situations. Our study focuses on the constructive feedback student receives from the teacher. Based on specialised literature we have selected and described a series of items that indicate, in different degrees, the efficiency of feedback given to the student. The results of the research may be of interest for the optimization of the didactic communication in the learning process.

Keywords: Feedback, Learning process, Didactic communication

1. Introduction

In a large sense, feedback, as form of inversed connection, is defined as the way through which the purpose becomes cause again. In a narrow sense, the same concept can be defined as all observable, verbal and nonverbal, information that allows an individual to appreciate the effects of his message (Amado and Guittet, 2007). Its lack in the act of communication means the emitter cannot determine the effects of the message. Under the circumstances there may appear misunderstandings, distortions, dissonant perceptions at the level of the receiver with negative impact on the process of communication.

Within the frame of education, efficient communication cannot be achieved without feedback. The act of daily didactic communication can be protected from possible variations, deviations and unwanted damage through the intervention of voluntary and involuntary feedback. Educational communication is, in fact, an interaction with permanent informational and socio-affective exchanges, in which the roles of emitter and receiver are alternately assumed by the teacher and the student. In this case, feedback is all the more necessary as it adjusts and reorientates the act of didactic communication according to the way the student receives and understands the message and according to the opinion the teacher has on this understanding.

As mentioned before, feedback is bidirectional, feedback given by the student to the teacher and feedback provided by the teacher for the student. We will limit our research to the latter as we acknowledge the importance of some information on the quality of students' learning tasks. Various studies (Gamble and Gamble, 1993; Abric, 2002; Pânişoară, 2009 etc.) have shown that absence of feedback can produce frustration, anxiety and demotivation in students. In this case, teacher's feedback becomes a stimulus for the students to keep on engaging in various learning and intercommunication situations until the desired educational outcomes. As a consequence, the research identifies several elements of feedback based on specialized literature and makes descriptive analyses using the data obtained from the students who participated in the study in order to provide both teachers and students with representative information concerning the efficient realization of didactic communication in the learning process.

Immediate feedback is feedback provided immediately after a task completion. It can be verbal, oral or written, as well as nonverbal. In order to be effective, immediate feedback should show variety in form, specify the particulars of an accomplishment so students know exactly what was performed well, should be offered in recognition of noteworthy effort on difficult tasks, foster intrinsic motivation to continue to pursue goals, be delivered without disrupting the communicative flow of ongoing interaction (Harmer, 2001). The type of information in feedback can vary: confirmation of in/correct accomplishment of tasks; short, sharp and snappy with plenty of opportunities to try things out again; answers on educational sites or software etc.

Interjections represent a verbal form of approval or disapproval. By using them the teacher expresses the dis/satisfaction for a task accomplishment. It is important to underline that positive feedback motivates students' performances on a long term, whereas negative feedback limits the effort of improving either communication or school performance. Generally speaking, there is preference for the use of approval interjections. However, attention has been drawn that, if used at short intervals and stereotypically applied, interjections can lose their stimulation value for learning (Nicola, 2000). Other studies mention that feedback characterised by praise has little impact on learner's performance as it provides learners with over-inflated perceptions on the execution of their tasks (Boud and Molloy, 2013).

Although nonverbal feedback is also immediate, we choose to study it separately as we consider it important from the student's perspective. Nonverbal feedback (eye contact, nodding, small facial changes etc.) can be transmitted consciously or unconsciously as answer to another person's communication (Gamble and Gamble, 1993). Nonverbal signs are numerous and represent clues for the message understanding. Expressions on teachers' faces can indicate the degree of interest in the educational message, eye contact creates a link between teacher and student, body language brings relevant information on the attention paid to the student and on the interpersonal relationships. Mention must be made that none of the above channels do not represent the absolute parameter according to which we can make sure the message has been correctly understood. The information must be interpreted within a context and through the corroboration of all clues to obtain the correct data.

Performance as an indicator of feedback is appropriate when it comes to skills and attitudes. Skills are practical abilities to do something, whereas attitudes are a collection of beliefs and values which determine the way people behave (Russell, 2000). Generally, the student becomes highly motivated and satisfied when s/he succeeds in putting into practice, as skills or attitudes, the content of some learning activities.

Grades provide a convenient summary of students' performance and inform the interested parties (both student and teacher) of the students' achievement. One of the main functions of grades is that of feedback, to provide students with information about their progress and achievement. In this case, the function of grades is formative, not summative in nature as grades are meant to facilitate students' learning by influencing their motivation and performance (Lipnevich, 2007).

Delayed feedback is informative, corrective feedback given to a learner after a specified programming delay interval during instruction or testing (Dempsey et al, 1993). The delay interval has been ranged from seconds after each item to more than a week after a task completion. As such, there have been identified several types of delayed feedback according to the time interval: item-by-item, logical content break, less than an hour (end of session), 1-24 hours (end of session), 1-7 days (end of session), extended delay (end-of-session), before next session (Dempsey et al, 1993). Irrespective of the time interval, this kind of feedback is generally more generous in content. It may be represented not only as mere grades, a common example of feedback, but also as reports that prove useful in the process of subsequent learning.

Self-assessment through checklists, criteria lists, records of achievement, self-grading makes students responsible for their learning process. If guided correctly, students can be extremely effective at monitoring and judging their own productions. This is important as students are taught to become autonomous learners by encouraging them to reflect upon their own learning. By teaching them to provide relevant feedback for their work, we equip them with a powerful tool for future development.

2. Research design

The objectives of the research are to identify indicators of feedback based on specialized literature, to make descriptive analyses using the data obtained from the students included in the study. The purpose is to provide teachers and students with relevant data to efficiently realize didactic communication and learning process.

The sample under investigation was made of 150 students from three school levels in Vrancea County: 50 gymnasium students, 50 high school students and 50 faculty students. Their ages ranged from 12 to 21 years old. The participation in the study was on volunteer basis, with random sampling which provided variety in students' appreciations.

The questionnaire-based investigation was used as the main method of research. It was built starting from the study of specialized literature and continued with the discussions in focus-groups with the students from the three levels of schooling. In conclusion, the elements of constructive feedback identified have been transposed into the following items: immediate feedback, nonverbal feedback, grades, delayed feedback, performance, interjections, self-solicited feedback.

Each item in the questionnaire comprised a five-step scale. The respondents had to choose only one of the variants of the 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. The procedure facilitated the determination of the impact for each item in the process of proficient learning.

3. Results and discussions

Table 1. Means and Standard Deviation of Feedback Forms Scores

Feedback forms	Gymnasium Mean (std. dev.)	High school Mean (std. dev.)	Faculty Mean (std. dev.)
immediate feedback	4.78 (0.418)	4.82 (0.438)	4.52 (0.786)
interjections	4.14 (0.729)	3.44 (1.280)	3.68 (1.253)
nonverbal feedback	3.70 (1.446)	4.42 (0.785)	4.40(0.743)
delayed feedback	3.26 (1.322)	3.36 (1.191)	3.92 (0.877)
performance	3.74 (0.944)	3.82 (1.137)	3.76 (0.870)
grades	4.36 (0.463)	3.38 (1.162)	3.20 (1.229)
self-solicited feedback	4.02 (0.820)	4.64 (0,763)	4.38 (0.679)

We used the means obtained to establish a hierarchy of feedback indicators for the three school levels. The indicator ranked 1 was considered highly relevant for feedback, whereas the item ranked 7 was the least appreciated.

Table 2. Descriptive of Classification of Feedback Forms for the Three School Levels

Rank	Primary school	Gymnasium	High school
1.	immediate feedback	immediate feedback	immediate feedback
2.	grades	self-solicited feedback	nonverbal feedback
3.	interjections	nonverbal feedback	self-solicited feedback
4.	self-solicited feedback	performance	delayed feedback
5.	performance	interjections	performance
6.	nonverbal feedback	grades	interjections
7.	delayed feedback	delayed feedback	grades

According to our descriptive analysis the highest means were registered for immediate feedback for all three school levels: gymnasium (m=4.78), high school (m=4.82), faculty (m=4.52). This shows that this form of feedback is the most relevant from the students' perspective since it offers concrete evaluation on the spot. The lowest means were registered for delayed feedback for gymnasium (m=3.26) and high school (m=3.36), and for grades for faculty (m=3.20). Gymnasium and high school students stated that feedback delay does not help them adjust their learning process in due time. For faculty students grades become less important as they consider them to reflect the theoretical issues more and the practical aspects of their initial professional training less.

All means that registered values above 4 indicate great relevance of the respective items for the learning process. Thus, at gymnasium there are four indicators with means above 4: immediate feedback (m=4.78), grades (m=4.36), interjections (m=4.14), self-solicited feedback (m=4.02). At this school level, grades are still important as they are used in small percentage for the entrance examination in the next level of schooling. Interjections provide a form of dynamic feedback increasing the energy level of any activity. Through self-assessment students get accustomed with concrete tools of assessment.

In high school there are three items that registered values above 4: immediate feedback (m=4.82), self-solicited feedback (m=4.64), nonverbal feedback (m=4.42). High school students become aware that accurate self-evaluation helps them enhance learning and form a clear image of their school achievements. At this age level, students are more attentive, even speculative when it comes to nonverbal communication.

At faculty level, three items registered means above 4: immediate feedback (m=4.52), nonverbal feedback (m=4.40), self-solicited feedback (m=4.38). With age, people develop the ability to catch more accurately the nonverbal aspects. Faculty students use this ability to adjust correctly their learning outcomes. Faculty students recognize the importance of self-solicited feedback as it helps them become autonomous learners and thus better equipped for their future professional development.

We have applied the T test for the independent groups in order to determine the difference on the opinions of the student groups. There were registered statistically significant differences with six items out of seven. Between gymnasium and high school there are significant differences for four items: self-solicited feedback, grades (higher means for high school than for gymnasium), and interjections, nonverbal feedback (higher means for gymnasium than for high school). Between gymnasium and faculty there are significant differences for the following items: immediate feedback, nonverbal feedback, self-solicited feedback, delayed feedback, grades, interjections. Higher means for gymnasium in comparison to faculty are for immediate feedback, grades and interjections and higher means registered in faculty by comparison to gymnasium are for nonverbal feedback, self-solicited feedback and delayed feedback. Statistically significant differences are also at the next level of analysis for two items: immediate feedback (higher means at high school than faculty), and delayed feedback (higher means at faculty than high school). All these statistical differences indicate divergence of opinions among the groups under investigation. The higher means indicate a greater relevance of the respective items for the learning process. The only item without statistically significant differences is performance which indicates convergence of opinions for the three categories of students questioned regarding the importance of this form of feedback for their learning process.

4. Conclusions

In conclusion, feedback has a positive, adjusting role to the learning process. It brings significant contribution to the construction of proficient situations of learning. It is also important as it leads to a change in the learner's subsequent performance as a result of the information input. There are several possibilities by means of which a teacher can facilitate the adjusting interventions of the feedback. The main issue is that the teacher to promote an authentic educational dialogue, to take care to develop skills of active listening in students, to encourage the affective rapports, to manifest flexible, cooperative attitude. Moreover, specialists (Boud and Molloy, 2013) draw attention that a continuity of the learner-educator relationship so that the educators develop a close understanding of the learner's work over time (including how the work changes in response to feedback) may be more important than the volume of feedback provided.

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The impact of the physical context on the efficiency of the didactic communicational process

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Abstract

The efficiency of educational communication is influenced, among other factors, by the ambiance and the comfort the interlocutors feel at their work place. Specialists in the field of the communicational phenomenon state that organising the space influences significantly the process of communication as a whole, and the nature of interhuman relationships in particular. The physical context is determined by all the characteristics of the elements that form the surrounding environment which might have a positive or negative contribution on the development of the communicational process. This study focuses on the degree of impact some elements of physical context have on the efficiency of didactic communication in classroom. Thus, the conditions of psychological, psychosocial, linguistic or of any other nature must be doubled by requirements specific to school space: technological, ergonomic and aesthetic. It is necessary that teachers should make sure that physical ambience is a triggering factor in the learning process. Depending on the interaction of all components of the physical environment, teacher-student communicational activities may be efficient from an instructional-educational point of view, or on the contrary, inefficient as communication is impeded and lacks educational valences.

Keywords: Didactic communication, Physical context, Learning process

1. Introduction

The educational process, didactic communication implicitly, develops in a certain environment and context which can influence its quality. One of the factors with great impact on didactic communication is the physical context. Lebrun and Berthelot (1994) define context as physical surrounding, material and pedagogical. The physical dimension of context is given by all spatial and material elements in which didactic communication occurs and which can influence the process of communication. Abric (2002) asserts that the material arrangement of space influences both the quality of the communicational process, as well as the quality of the psychosocial relationships. Environment or context act through the stimulations, the pressure, the constraints, the inhibitions they exercise, through the models they offer, through the situations they create, through the information or content they provide, through the reactions they cause in students (Cerghit, 2002). Hence, the efficiency of educational communication is determined by the ambiance and the comfort felt by the interlocutors in the space where the activity takes place. The material conditions influence the ampleness, the start, the continuation or the blocking of communication in education.

The main element of the educational space is represented by school furniture. It is composed of a series of pieces of furniture used in school environment as additional support to accomplish the intended educational outcomes. The modern attributes of classroom furniture are simplicity, functionality, durability, the instructional function and modularity (Iucu, 2006). Flexible spaces, with variable geometry are preferred to the fixed bolted ones. They allow diverse spatial arrangements which favour, according to the case, either free interpersonal communication or individual work. In order to sustain intercommunication, the arrangement of classroom furniture in diverse and flexible structures becomes important. Book and Galvin (Pânişoară, 2003) state that proper arrangement of classroom furniture has at least four advantages: it reduces the authoritarian role of the teacher, it provides the sensation of equitability to all participants in the group, it reduces the possibility that a member of the group to be ignored by the group, it helps create the responsibility of mutual listening and contributions to discussions.

There have been studies that attest that face-to-face position favours a good development of intercommunication as it offers everybody equal status. As such, in classroom the teacher should consider seating arrangements in patterns of semi-circles, U-shapes, concentric circles and one circle so each member of the classroom team should be able to see one another, to talk to another, to create different interactional activities and better studying and working conditions (McLeod et al, 2003).

Although it may appear trivial, students are profoundly affected by what they see and hear and how they see and hear in the classroom. Visibility is concerned with the orientation of furniture according to the light source, light intensity and health of the children. The last item refers to children with eye deficiencies, hearing problems and children with various heights. As a rule, the students with eye and hearing deficiencies stay closer to the blackboard or the teacher, whereas tall children stay at the back of the classroom if the desks are all lined up in columns perpendicular to the front wall of the room. However, these arrangements are not always satisfactory for the students and it is the teacher's duty to intervene as creatively as possible.

Sitting arrangements can be both a source of dysfunctions in educational communication, as well as a chance to create positive, harmonious relationships among students. Who sits next to whom? As a rule, students fall into a comfortable pattern of self-selection in where they sit. If the teacher gets involved, then s/he should pay attention to the relationships among the students: preference, rejection, indifference etc. If some adjacent students are disruptive, then the teacher will decide to selectively move some of them. If these are taken into account, then the teacher creates the premises of a favourable microclimate of instruction and communication transposed into: direct involvement in the activity, student cooperation, flexibility in varying the pace of the activities, motivation and a sense of security etc.

Andy Green (2009) claims that teacher's position in the classroom is very important for successful intercommunication. In order to attract attention, to create a good rapport, to install a positive energy, to invite to dialogue, it is necessary for the teacher to leave the comfortable space of the teacher's desk as this one may be considered a physical barrier between teacher and student. In order to be seen and heard, the teacher must move among the students, especially during activities based on dialogue.

Classroom ornamentation deals with the cultural and aesthetic environment of the classroom. Sets of photos, an exhibition with students' work results, aesthetic elements etc. constitute opportunities of expressive culture configurations.

Teaching aids, as elements of physical context, can be largely defined as materials selected for classroom use. According to Nunan (1988), they are essential elements within the curriculum and do more than simply facilitate the wheels of learning. At their best, they provide concrete models of desirable classroom practice and fulfil a teacher development role. The audiotapes, the videotapes, CDs, the video projector, the computer and interactive blackboards contain educational messages, combine different channels of communication, supplement the verbal explanations, support didactic communication.

Multimedia are technologies that operate together to acquire, process and render information that comes from different other means. These new technologies, available through the computer, have opened a new perspective on educational environment in general. There are a rich variety of software packages with applications that are extremely attractive thanks to the clear, colourful, dynamic images accompanied by words, written or spoken, music and other sounds. Some of them are endowed with editing, graphic, video, sound and text processing tools. Their use in support of intercommunication is obvious as long as the information provided can be discussed upon, commented on, analysed, compared etc.

2. Research design

The objectives in the research are: a) to identify the elements of physical context that may influence the efficiency of didactic communication at primary school, gymnasium and high school levels, starting from specific literature; b) to realize a descriptive analysis of the elements of physical context in order to establish their hierarchy for each of the three levels of schooling, starting from the teachers' appreciations.

The sample involved in our study included 150 teachers (50 for primary school, 50 for gymnasium and 50 for high school) from Vrancea County, Romania. The participants' selection was based on willingness to take part in the study. They are from both urban (65%) and rural areas (35%). The teachers have at least 10 up to 30 years of experience in the educational system. 107 of them are women and 43 are men with ages between 32 and 55.

The instrument of research was a questionnaire which recorded teachers' opinions regarding the impact of the elements of physical context on didactic communication. The questionnaire was developed starting from the specialized literature mentioned above and also from discussions in focus-groups with teachers from each of the three school levels. This enabled the identification of a series of elements of physical context with impact on didactic communication transposed into the following items: seating arrangements, furniture functionality, visibility and acoustics, classroom ornamentation, sitting arrangements, teacher's position in the classroom, technological teaching aids.

The respondents were asked to answer depending on how much they appreciate the degree of impact of the indicators in the questionnaire. Each item of the questionnaire comprised a five-step scale. They had to choose one of the five variants: (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. The results were further subjected to analysis. In order to realise descriptive analysis we have used the SPSS software, the t-test for the independent samples and Levene test. Descriptive statistics of the scores obtained in the study are presented in Table 1.

3. Results and discussions

Table 1. Means and Standard Deviation of Physical Context Elements Scores

physical context elements	Primary school Mean (std. dev.)	Gymnasium Mean (std. dev.)	High school Mean (std. dev.)
seating arrangements	3.84 (1.218)	3.86 (1.178)	4.32 (0.894)
furniture functionality	3.30 (0.404)	3.32 (0.891)	3.28 (0.607)
visibility and acoustics	4.18 (0.839)	4.22 (1.178)	4.16 (0.896)
classroom ornamentation	3.88 (1.189)	3.60 (1.030)	3.64 (1.025)
sitting arrangements	4.56 (0.610)	4.58 (0.538)	4.30 (0.735)
teacher's position in the classroom	4.60 (0.495)	4.54 (0.646)	4.52 (0.769)
technological teaching aids	4.38 (0.667)	4.36 (0.663)	4.62 (0.602)

Starting from the means obtained in Table 1 we have established the hierarchy of physical context indicators with impact on the efficiency of didactic communication. Thus, the physical context indicator in the 1st rank has the highest impact, whereas the indicator in the 7th rank has the least impact on didactic communication.

Table 2. Descriptive of Classification of the Physical Context Elements for the Three School Levels

Rank	Primary school	Gymnasium	High school
1.	teacher's position in the classroom	sitting arrangements	technological teaching aids
2.	sitting arrangements	teacher's position in the classroom	teacher's position in the classroom
3.	technological teaching aids	technological teaching aids	seating arrangements
4.	visibility and acoustics	visibility and acoustics	sitting arrangements
5.	classroom ornamentation	seating arrangements	visibility and acoustics
6.	seating arrangements	furniture functionality	classroom ornamentation
7.	furniture functionality	classroom ornamentation	furniture functionality

The descriptive analyses of the means obtained showed that the highest means were registered for different items for each school level: teacher's position in the classroom (m=4.60) for primary level, sitting arrangements (m=4.58) for gymnasium and technological teaching aids (m=4.62) for high school. At primary school and gymnasium there are means above 4 for four items: teacher's position in the classroom (m=4.60), sitting arrangements (m=4.56), technological teaching aids (m=4.38), visibility and acoustics (m=4.18) at primary level, and sitting arrangements (m=4.58), teacher's position in the classroom (m=4.54), technological teaching aids (m=4.36), visibility and acoustics (m=4.22) at gymnasium. At high school there are five items with means above 4: technological teaching aids (m=4.62), teacher's position in the classroom (m=4.52), seating arrangements (m=4.32), sitting arrangements (m=4.30), visibility and acoustics (m=4.16). The high means demonstrate that the respondents considered the items important for the impact on the efficiency of didactic communication. The lowest mean is for furniture functionality for primary school (m=3.30) and high school (m=3.28) and classroom ornamentation (m=3.60) for gymnasium. With the other items, the hierarchy varies as shown in Table 2.

For further analysis the t-test for the independent groups has been applied in order to determine the differences of opinions among the three groups of teachers. The analyses were realised between primary school and gymnasium, primary school and high school, gymnasium and high school. As a result, we noticed that there are not significant differences between primary school and gymnasium, which demonstrate convergence of opinions of the two categories of teachers questioned. Nevertheless, the hierarchic orders are different for each level. There are statistically significant differences between primary school and high school for two items: seating arrangements and technological teaching aids. For each of the items the higher means were registered for high school demonstrating that teachers from this level of schooling appreciate these items as more important for the efficiency of didactic communication. Between gymnasium and high school there were obtained significant differences for three items: seating arrangements, technological teaching aids (higher means in high school than gymnasium) and sitting arrangements (higher means in gymnasium than high school). The ways of improving didactic communication through factors of physical context appreciated similarly by the three groups of teachers with statistically insignificant differences are: teacher's position in the classroom, furniture functionality, visibility and acoustics, classroom ornamentation.

4. Conclusions

The concern for the optimization of the communication process through elements of physical context should be of importance for teachers in all school levels. Thus, the analyses in the research are not a consequence of the theoretical justifications, but derive from pragmatic necessity. The educational space improvement according to necessities depends upon the teacher's degree of involvement, creativity and desire to break some of the clichés (such as arranging desks in columns).

The notion of context underlines the integrative character of all elements. The results in the study certify the necessity of constant, interdependent involvement of as many as possible elements of educational communication in order to obtain improved results in the learning process. Furthermore, the means above 4 for four items out of seven for primary school and gymnasium and for five items out of seven for high school confirm that teachers are aware of the importance of the physical context factors for successful educational communication. Moreover, during discussions in focus-groups teachers mentioned that they are willing to make changes regarding the physical context, all the more students are receptive to new and thus get involved more eagerly in activities. From this point of view our study may be continued with analyses of students' opinions concerning the elements of context which they consider stimulating for a deeper involvement in school activities.

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Tool for identifying determinants of youth's migration

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Abstract

Worldwide, migration for education became an increasing phenomena with impacts on socio-economic and human development. From Romanian researchers and decidents perspective, is important to take stock of the present situation of flows of Romanian young people who decide to continue their studies in another country and, more than that, to know and monitore the reasons and key factors that underlying decision to leave the country and moreover, their decision to return home. The objective of the paper is to present the methodological framework of a virtual tool for identifying and monitoring the determinants and factors of intention of young people to migrate for studying abroad, from the perspective of in terms of perceptions, expectations, needs. The method consists in collecting and interpreting information about factors that may determine young people to migrate. Actually, the tool will be represented by a questionnaire for gathering information on specific determinants and one adjacent program (soft) for identifying students who are about to decide to migrate. The research is aimed to offer a complete image of potential factors that could be translated in causes of youngs migration and is designed to take part of the mechanism of targeted action for monitoring and encouraging behavior to return to Romanian labour market.

Keywords: youth, migration, innovative tool fordeterminants of student migration,

1 Introduction

In a globalized world, knowledge, skills and qualifications of the workforce are key factors of competitiveness and progress so that human capital development is esential for development of the states.Educational migration or transnational mobility in order to acquire new knowledge, skills and competences, is one of the fundamental ways in which young people strengthens employability, and their personal development, creativity and active citizenship in a intercultural environment.

Facilitating the mobility of individuals in order to study is one of the main objectives of the Bologna Process. In London Communication of May 2007, the Ministers responsible for higher education in the countries participating, claiming that "mobility of academic staff, students and graduates is one of the central elements of the Bologna Process, creating opportunities for personal development, development cooperation international between individuals and institutions, enhancing the quality of higher education and research, giving substance European dimension".

1.1 Interdisciplinary approach to migration decision

There is no single theory widely accepted by scientists for migration phenomena. The research is interdisciplinary, involving sociology, economics, demography, geography, psychology and political aspects.

The research of decision making from a behavioral perspective has a growing relevance. In our case, we align our informations and results of behavioral studies that integrate concepts from psychology and economics, with direct applicability in the real world such as education, macroeconomics, labor market finance. Understanding the irrational forces that influence the decision to migrate,in case of Romanian young people for example, could be a first step in understand them and shaping better policies. The interdisciplinary approach is an alternative that can provide this kind of responses. One of the main practical benefits of this approach that combines cognitive psychology and microeconomics, is to show us how the environment could influence our own perceptions and behavior needs.

Individuals can be irrational, impulsive and attaches importance shares with immediate results at the expense of beneficial beneficial in the long run.

If we recognizes that there are other factors that influence over the education and careers (other than universities prestige, income level or degree of information that we possess), individuals could make more realistic choices that meet their needs.

2 Educational migration

Educational migration is defined by mobility or movement of students and/or young peoples for studying outside their country of birth or citizenship, for a period of 12 months or more.

In the current globalized world, the internationalization of higher education has increased continuously and has become an activity which is directly related to supply and demand in the market. With the rapid growth of mobility for citizens and international educational opportunities and offers, more and more students choose to continuu different forms of education, especially higher education, in other countries than their home countries. Sometimes, many young citizens believes the study in another country could be a first alternative to offer them a permanent residence in another country.

Young people who migrate for studies bring considerable cultural contributions of information, capabilities and skills valued in the host countries. In many countries and universities were implemented initiatives, programs and measures to encourage and facilitate the arrival and integration of foreign students, including substantial changes in policies and immigration and visa procedures.

Mobile students or young migrants seeking new destinations worldwide.The number of international students has grown considerably in the early 21st century. According to the Organisation for Economic Co-operation and Development (OECD), in 2000 the overall number of students enrolled in tertiary education outside their country of citizenship was 2 million; by 2012 the number had increased to 4.5 million.

Worldwide, increasing number of students mobilized or migrant reflect the desire and behavior of the expansion of enrollment at the university, for young people worldwide. Higher education institutions worldwide seeking to attract people who have the best performance.

Some countries are traditional considered as destination centers such as the United States and the United Kingdom, and remain strong magnet for students seeking high quality education. Appear still new countries of destination and regional centers competing to attract the intellectual capital of students willing to study in another country. In 2013, over 4.1 million students have gone abroad to study, to almost 2 million in 2000 (data UNESCO).In 2013, there are six destination countries that have hosted almost half of worldwide migrant students. These countries are: USA (receiving 19% of mobile students worldwide), UK (10%), Australia (6%), France (6%), Germany (5%) and the Federation Russian (3%). In East Asia and Pacific, traditional destinations are Australia and Japan, but increasingly more students go to China, Malaysia, Republic of Korea, Singapore and New Zealand, which received 7% share of global mobile students in 2013. among Arab states, especially Egypt, Saudi Arabia and the UAE are working to recruit students from abroad. These three countries have hosted in 2013, 4% of total mobile students.

It can be seen that if the stated purpose of migration of young people is the decision to study or continue studies, the phenomenon is undergoing great variations becouse the motivation of the decision is different from country to country and from region to region. However, according to statistical data analysis, we note that the primary motivation of youngs is to leave the country or region of origin in the hope of ensuring a better future after graduation but not necessarily return to their country of origin. That is why the so-called mobility foreducation are gaining some migration features.

2.1. Factors that influence increasing student migration

There are many factors contributing to the growing numbers of student migration. Many developing countries have an under supply of university places to satisfy demand and as a result students have no other choice but to study abroad. In Romanian case, youngs want to migrate to developed countries with more advanced education institutions than their own.

Migration opportunities are one of the major contributions to the growth of student migration. Higher education has become a major global export commodity with developing countries capitalising on domestic shortages by recruiting foreign students. Sometimes, the most influential reason of students who chooce to study abroad was not because of academic reputation, but the opportunity to gain permanent residency and work in destination country.

An important factor influencing the student migration is the desire to study in a language other than the student's first language. For example, a growth in the number of students travelling to study in the UK from Central and Eastern Europe has been partially attributed to the wish to study in a higher education environment where communication is in English (Catterall, 2010).

3. The decision to migrate for education

The literature tends to highlight the role of student migration as gains of human capital development, but their role as high-skilled workers has received less attention.

From Romanian labour market perspective, the current rising trend of migration for education might have two opposite sides. We risk that many of our best students go for studying to foreign higher-education schools without returning to their home country.

The host country benefits from harnessing the knowledge and skills of young graduates. Country of origin loose a great potential, if young people do not return to their home country, and "brain drain" means to waste work potential and added value that could lead to an economic development purposes. The contribution would be significantly higher than the general population that you train without higher education.

Arguments for such an exodus of young people are clear. On the one hand, the existence of an environment that gives young people the opportunity to study in an high-quality educational institutes and provides a relevant and international recognition of qualifications obtained. On the other hand, the prospect of higher material incentives and promoting the best students in research activities or powerful multinational companies.

The moment of the decision to migrate is important. In many cases, the decision to migrate is linked to certain transitions between educational cycles, such as university or high schools, and in some programs forpostgraduate or to perform certain training in companies and institutions (internship) for young people.It is therefore important to study the information and availability of statistical data on mobility and migration of young people in terms of their intrinsic purpose and motivations of young people in conjunction with each of the characteristic features of the phenomenon.

Next, we focus on the actual determination and evaluation of the determinants of migration decision to studies, analysis and features from using the most appropriate assumptions phenomenon.

3.1. The determinants of decision for migration

The decision formigration is complex and include a variety of factors.

Traditionally, the youngs' decision to study abroad has been explained from the perspective of human capital theory. One person will choose to migrate if this means acquiring an experience or recognised competences that will improve theirs future profesional career as etter job opportunities and/or to increase their future expected income.This rather simplistic cost-benefit model has recently been challenged by new theories. In that case, people move for non-pecuniary reasons. Students appreciate the context in which they will study, or future opportunities to obtain permanent residence.

The argues come from a multidisciplinary approach.

Educational and professional reasons are dominant, but cultural and travel opportunities also count. Much of the literature focuses on students who choose popular English-speaking destinations.

An essential question for researchers concerns what motivates the migration decisions of international students. In their study of Slovakians who studied in the UK, Baláž and Williams (2004) show the relevance of the developmentof english language skills for Slovakians who studied in the UK.

Hazen and Alberts (2006) found that the most influential factors are professional and academic factors in the migration decisions of international students in the United States.

Other studies (Findlay et al. 2012) support the emphasis on professional and academic

reasons. The most frequently cited reason for studying abroad was to attend a world-class institution with prestige. It was important for students if the institution was „recognised".According to another study, the key factors governing the choice of destination among students studying in another country were the costs, the environment and the quality of education (Collins, 2008).Elina Eskelä (2013) demonstrates that earlier results concerning the factors affecting international student migration are also valid in the case of an uncommon destination country. Students migrate for the same reasons: they want to develop their skills and embark on a career, as well as to travel and learn about different countries and cultures. Even if theinternational student population is growing and diversifying, it appears that the motivations for mobility is the same.

3.2. The toolfor identifying determinants of youth's migration

Their principal objective of this descriptive study is to collect information on the decision factors, rational and irational, even known or newly detected, applied to young people seeking for institutions of tertiary education.

The migration decision is based on the analysis about needs, expectations, perceptions and priorities of the youngs who choose the appropiate way.

The steps underlying the decision making processare:

1. Recognition of the need by perception of a difference between the desired situation and the existing situation, this has the role to activate and start decision dor educational decision;
2. Information and seeking arguments to justify this decision, both in their own thinking (internal research) and acquisition of relevant information from the environment, the group of friends or institutions (external research).
3. Evaluation of alternatives in terms of benefits and correct identification of bestchoise.
4. The decision:action for putting into practice thechoise.
5. Evaluation of decision and feedback - evaluating the choise in terms of meeting the individual needs and expectations.

The research method for identifying the determinants and factors of intention of Romanianyoungs, students, to migrate for studying abroad, in terms of perceptions, expectations, needs is based on survey based on questionnaire.

The questionnaire will include a selection of questions for determinants and factors of intention (independent variables) influencing migration as described by the migration literature and adapted through our research work. The items are related to factors influencing migration, including economic and non-economic factors like perceptions, expectations, needs.

For example, variable with economic impact that influences migration are: finding a well-paid job; finding a job with opportunities for career perspectives, finding a job in a specific domain of activity etc. There are some variables for social membership and community as proximity to familly, relatives, or finding a job that allows for a quality work-life balance. Some important variables are dedicated to factors as percepţions, expectations and needs for devepoment. This latter become more important in youth decision for migration. Young people are seeking for jobs and organisations that develop innovative thinking, develop their creative skills, and wish to have a positive contribution to society.

For high-skilled students, there are many factors that determine their migration intentions. For example, there are new factors, big demands and high expectations more important than traditional factors like job and income. This refers to modern lifestyle and innovative thinking, like multicultural working environment and opportunities for travel and discover opportunities emerging as leaders in technology.

Conclusions

Also monitoring all aspects like determinants of decisionfor migrations is importantfor implementingthe right migration policies at national, regional and European level. The impact of the phenomenon is felt in all areas, not just economic but also social, demographic, education, social security, both in destination countries and in the home.

There are many influence factors contributing to the growing numbers of student migration. Performingin-depth identification of factors and determinants of migration for study, will bring new information about potential areas of intervention and gouvernamental measures. Interpretation of results in decisive moments for choosing educational pathway of young Romanian could make the difference between migrate or remain and continuu studies in country.

Information obtained and monitor their changes over time can be used on three areas of intervention: first identifying the determinants and factors of decisions to migrate for studying abroad, in terms of perceptions, expectations, needs. Secondly, the universtities will be able to adjust their curricula to atract more students and keep the ambitios one who know what they expect from life and society. In the third line, the policy makers and decidents from educational system would have more opportunities to intervention for attracting young people in Romanian system or to facilitate their return to country after graduating.

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Involvement Computer in Teaching in primary school - New Perspectives and Challenges

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Abstract

For the XXI century students, the computer becomes the main instrument of learning and practicing of their achievements. It is an open way to learn the answer of any questions, independently and at their own pace. However, the teacher directed learning is really improved in the educational process by the availability offered by new technologies?
The present study aims at identifying the types of activities in which teachers mainly use the computer and what areas there are where he may step effectively in the transmission of information, the acquisition and consolidation of knowledge, skills and abilities.

Keywords: new technologies, primary school, applications

1. Research context

Nowadays, new technologies are part of our lives putting their mark on daily activities, from the personal to the professional. For students in the XXI-th century computers become the main instrument of learning and practice of acquisitions, an affordable way to learn independently and at your own pace, answers for any questions.

In the last twenty years resources computerized entered progressively in the lessons in primary school, because today, in large proportion, schools benefit from their support. Also, the internet connection has changed over time the computer role, bringing obvious benefits through access to a huge content of information and the accessibility of communication with professionals worldwide.

Computer is a tool that intervenes in the act of teaching and learning, it influences the educational process, proposing a new range of cognitive activities and tools. Thus, the teaching role of the teacher and students must be reconsidered in the teaching process. Under the influence of new technologies, the didactic triangle – teacher-student-knowledge – (Houssay, 2000) turns into formative pyramid (Poisson, 2003), the inclusion of yet another pole represented by technology.

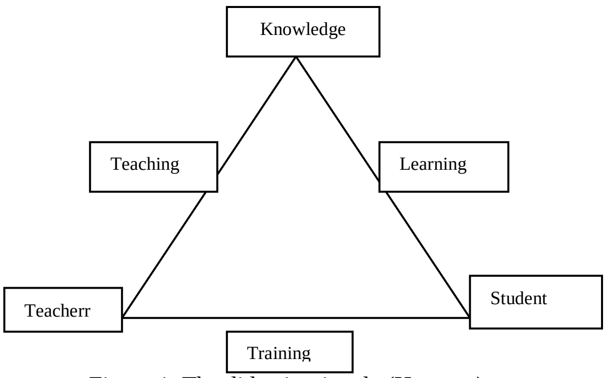

Figure 1. The didactic triangle (Houssay)

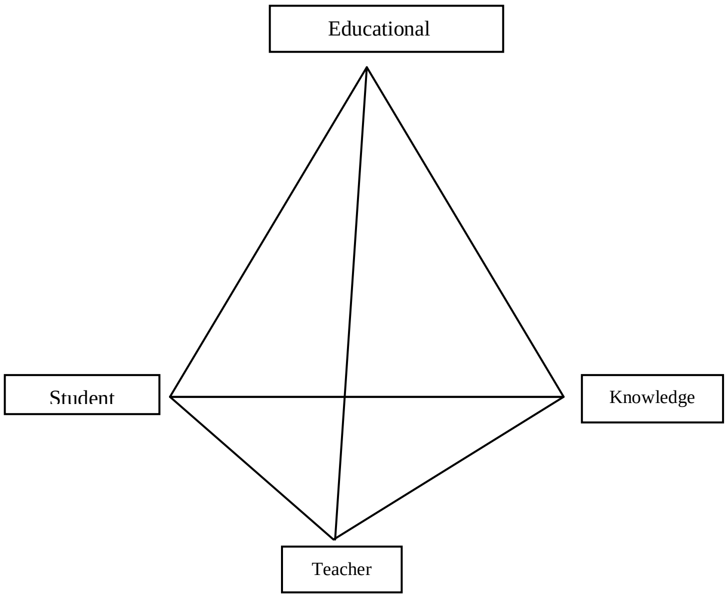

Figure 2. The formative pyramid (Poisson)

Thus, the teacher can not be limited only to convey information to students, but to provide for mediation of knowledge, which is supplied by him or from sources computerized. Once involved the computer teacher interacts with the student through it, which changes the relationship of teaching and learning.

The present study intends to show the diversity of approaches which primary teachers may use and the complexity induced by ICT integrated in lessons, and to outline paths to improve their use. Thus, under the current activity one general solution available can not be applied, because there is a great diversity of computerized materials to be adjusted.

The computer is a resource that can be exploited in multiple ways (Pochon et Blanchet, 1997): as a means of repetition and practice, as a illustrating, as a building stand, as a means of organizing communication, as a means of communication itself as a way of correspondence among schools.

2. Objectives and research methodology

2.1. Objectives of the study

Generated by the real need for practitioners to operate as efficiently as possible the new technologies for teaching purposes, this study aims at identifying the types of activity to which the teacher uses mainly the computer and which are the moments during didactic activities where new technologies can effectively intervene in transmitting information, acquisition and consolidation of knowledge, skills and abilities.

In our research we have focused on the following objectives:

- Identifying the main types of professional activities in which teachers mainly use the computer;
- Highlighting the main applications used in the preparation / development of lessons in primary education;
- Revealing the lesson steps that demonstrate the effectiveness of computer use.

2.2. The research methodology

In order to obtain the information needed to carry out this study the survey method was used, for which a questionnaire was developed that was distributed to a group of 82 primary education teachers. Of the 82 completed questionnaires 80 were validated, errors are due mainly to fields left blank or incorrectly completed. Also, data were corroborated with observations made during special school inspections and professional practice that enabled the collecting of information relevant to our study.

3. The sample structure

The investigated population consists of 80 teachers from primary education, a sample with a heterogeneous structure. The sample can be described by the following factors: age, level of education, level of continuing education, origin, which have enabled the collection of data relevant to the proposed theme.

3.1. Age distribution. In terms of age, the highest number, 35, represents the category of persons aged 30-40 years. Other age categories - 19-30 years, 40-50 years, 50 years - have almost equal shares, being represented by 15, 14 and 16 subjects.

The age variable is particularly important as subjects belong to different periods of initial training, where modern means were more or less present. Thus, it is useful to note the influence of this variable in choosing these means in the preparation, organization and implementation of activities in the classroom, trying to see if new technologies are often accessed by young academics or are present in all age groups.

3.2. The distribution by level of study. Among the 80 teachers surveyed, only four are graduates of pedagogical high schools, six are graduates of post-secondary school and 70 have university degree while among these 15 are Postgraduate Masters.

3.3. The level of continuous training. 43 of the 80 subjects have the teaching degree I, 25 have the second degree and 12 only the definitive.

3.4. The area of origin. 56 teachers work in urban areas and 44 of the subjects are enrolled in the rural sample.

4. Analysis and interpretation of data

When questioned on the types of professional activities that use primarily the computer teachers indicated a wide range of activities. Thus, 75 of the respondents use it , in projecting the teaching process, 58 in preparing lessons, both for research and for developing tools or didactic materials. The stage preceding the teaching process involves a documentation component where traditional means of information such as auxiliaries, curricular documents, blended with the electronic components as well as a component of creating educational resources. The access to information means facilitates both a scientific and methodical informing as well as a better creation of didactic materials that can meet the criteria of both content and form.

77 of the subjects use a computer in conducting proper lessons with a frequency greater than or less dictated, most often, by the access that teachers have to the materials available to the school (computers, projectors, laboratories computer, internet, educational software).

Therefore, there is a wide use of the computer age variable not influencing significantly its use; teachers over 40 years, although they have not received initial training in ICT in school, have acquired basic skills within university training or continuous training activities.

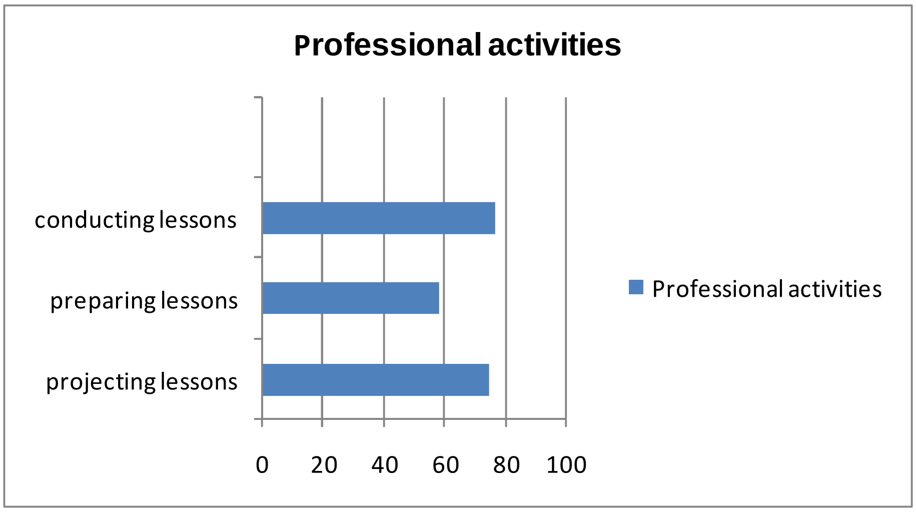

Figure 3. Computer usage in professional activities

Computer usage in school at primary level is influenced by a number of factors imposed by the aims pursued but also by the activity structure. With reference to the stages of the lesson, we found that integrating computer in activity is performed by our respondents in: updating knowledge (23), focusing the attention (35), guiding learning, / consolidation (67), obtaining the performance (72) , evaluation (21). These data lead to the conclusion that the computer is a constant presence in establishing _ teaching activities with young schoolchildren demonstrating their usefulness especially in moments of teaching and learning itself. It thus appears that computer usage in primary education contributes to a better rationalization of teaching, encouraging active and interactive children participation, enabling faster feedback and an increase in the attractiveness of learning.

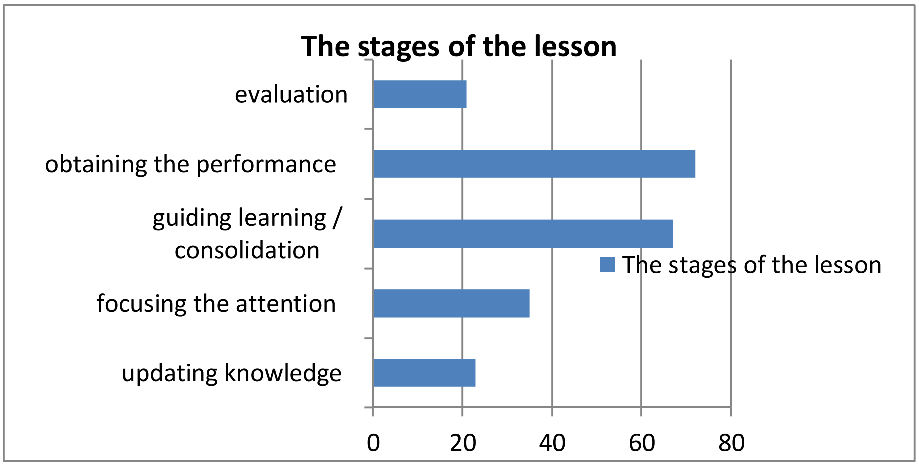

Figure.4. Using computer in lesson

Another objective of the study focuses on the types of applications preferred by teachers in their activity at primary school (Logofătu, M.F., 2008). It appears that applications commonly used in preparing /developing lessons are:

- Microsoft PowerPoint application - 75 subjects preferred by because the information presented in visual form are perceived and retained more easily than those transmitted exclusively orally allowing these presentations merge visual elements with the hearing and dynamic. It should be considered the fact that there are numerous online didactic materials in this format, disseminated by professors, which can be easily accessed and used in lesson;
- Application Paint - was indicated by 20 teachers, its use is important because it enables the implementation of ideas related to exercises (visual memory, skills based colouring, the formation of numeracy by drawing / visualization, intuition of letters). It is noteworthy that this application proves its usefulness especially in the first two grades of primary school, when students get accustomed to writing the new code, but also with shapes and colours.
- Microsoft Word application - used by 71 subjects - enables better preparation of lessons by designing worksheets and other didactic materials used in the activity. Through multiple options that the application holds (formatting paragraphs, removing the text, writing texts with different fonts, styles, sizes and colours, spelling and grammatical automatic writing artistic texts etc.), the teacher can prepare materials to express their creativity. In conducting the lesson, Microsoft Word documents can be made accessible to students in frontal activities through designing with video projectors.
- Excel - used by 15 respondents for simple mathematical operations, can help a student in carrying mathematical calculations or warns if it is the wrong answer, contributing to the formation of self-assessment skills.

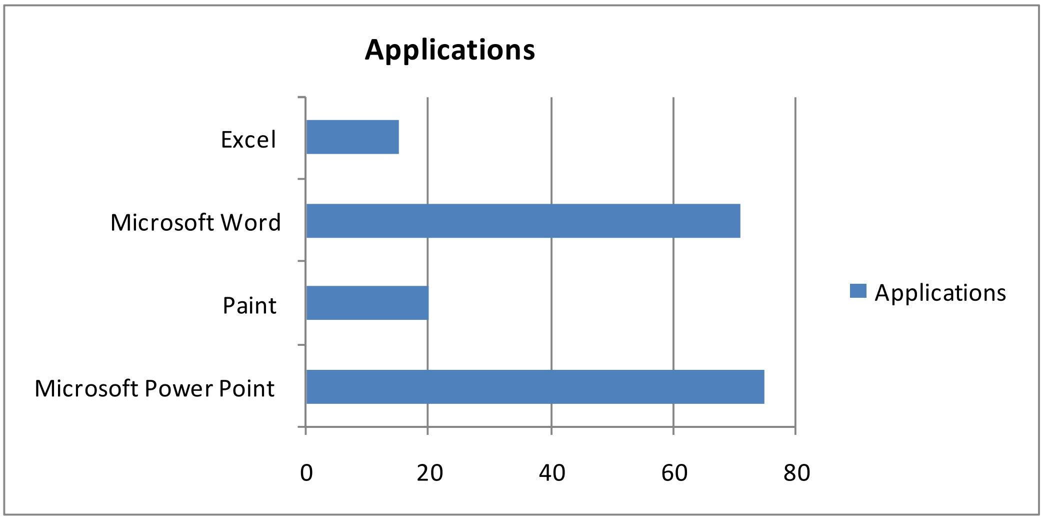

Figure 5. Applications used in lesson

5. Conclusions

Many teachers are willing to use the new technologies in teaching and this is either an improvement in learning, or time savings.

The advantages of using the computer in activity with young schoolchildren are: stimulates innovation and modernization of teacher's work; enables better management and use of didactic time saving the teacher from a series of repetitive or routine tasks, leaving more time for individual coaching of the student; facilitates understanding phenomena because it adapts perfectly to the particularities of children who is visually by excellence; causes and develops interest in activities, causing a strong emotional student participation.

Concerning saving teaching time the problem involves two paradoxical realities. On the one hand, in the teaching process there is better management of time, eliminating the downtime, but on the other hand, familiarize teachers with the technology; the preparation of an activity involving the computer requires quite a long time. Using tools requires the development of digital skills that can not be formed except by systematic practice.

Although the vast majority of teachers believe that ICT tools have their place in school becoming necessary to students, this is not reason enough to integrate them into activities. In order for teachers to be determined to use the computer in classes it is necessary that cost of time and energy underlying the creation of teaching materials should not be too high when compared with the benefits which must be real and evident. Thus, if the integral development of materials implies a time-consuming, an alternative useful for teachers is the online learning resources or educational software.

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From English to Emojis: A New, Simpler, Digital Language ?

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Abstract

My paper looks at what is hailed by experts as the emergence of a new digital language, that of the emojis. I intend to examine how, and more importantly why, communication on mainly Facebook and Instagram has evolved from a stultified Internet English to an even more simplified way of getting one's meaning across. At the same time, I assert that emojis are a natural progression of the visual culture we are living and generating content in.

Keywords: emoji, digital language, written language, visual culture, digital communication

1. Introduction

Young people cannot seem to envisage communication on mobile devices without them anymore. The Oxford Dictionary named one as the Word of the Year in 2015. And it is not even a word. It is an emoji, a picture that roughly translates as "laughing with tears of joy." However, it was not these words that received the award, it was the image itself:

Both as a digital entity and as a word, the emoji originates from Japan where, long before the age of smartphones, teenagers had been using them on pagers (Clark, 2015). It is important to point out that the Europeans, too, had had an equivalent, the emoticon, or the smiley, created in 1982 by Scott Fahlman, a computer scientist. He devised a sideways smiling face :-) in order to deal with confusion on Internet messaging boards in distinguishing between serious or joking content.

The difference between the emoji and the emoticon is that the former is now a fully-fledged picture, no longer requiring a combination of keys. At the same time, emojis are not only facial expressions, they are also animals, food, fireworks, buildings, or cars. In the Western mobile phone communication the emoticon and the emoji coexist peacefully.

In 2010, the Uniboard Consortium, consisting of representatives from the current digital powerhouses, namely Microsoft, Apple, IBM, Adobe Systems or Google, approved a fixed setoff emojis to bring into worldwide circulation. In 2011, Apple introduced it to its iOS5. Samsung quickly followed suit on its Android phones. Since then, the use of emojis in communication has exploded. For instance, trackers say that, at the moment, 92% of all people employ emojis (Thompson, 2016). In 2012, a year after Apple introduced the emoji keyboard, Instagram, another blogging platform, reported that 20% of its users employed them. In 2015, the number rose to 40%. And, perhaps not surprisingly, users on Instagram tend to use emojis more than those on Facebook. But we will come back to that later.

The rise in the number of people using emojis when they communicate has been so steep in these five years since their introduction to digital culture that it has prompted some voices to contend that emoji stands on the verge of evolving into a completely new, pictorial language. To support that claim, both parties point towards various efforts which have resulted, for instance, into the translation of Herman Melville's *Moby Dick* in emojis (*Emoji Dick*):

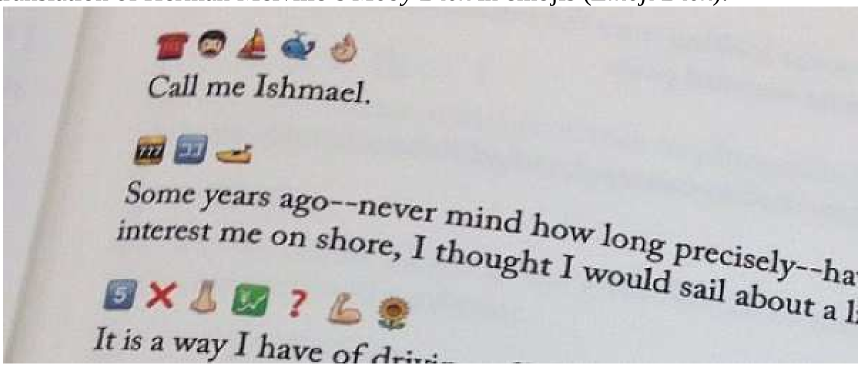

Figure 1: First page of Emoji Dick

The creations of Joe Hale are another illustrating example. The artist has transformed several famous children's stories into emoji posters, namely Lewis Carroll's *Alice in Wonderland* which has been reinterpreted with emojis into what is known as the Wonderland Emoji Poster, *Peter Pan* became the Neverland Emoji Poster, and *Pinocchio*, the Pleasureland Emoji Poster.

The Bible has also been anonymously translated in emoji on Twitter and Beyonce's "Drunk in Love" video has received the same treatment.

What I want to say with these examples is that emojis have become a serious phenomenon, independently from the back-and-forth of conversation on Facebook or Instagram. But are doomsday claims of them killing off the written, English language true?

2. Emojis, broken English and visual culture

The surge of hearts, laughing with tears of joy, and toothy grins in digital conversations is not surprising for two main reasons.

Firstly, as we all know, emojis add the all important emotion to a written, digital conversation which is usually devoid of any intonation or visual cues. Their Japanese name, *emoji*, is informative: *e* – picture, *mo* – writing, *ji* – character (Clark, 2014). The European variant, emoticon is a portmanteau word made up of "emotion" and "icon."

Secondly, digital culture is also powerfully visual, which is demonstrated by the popularity of Instagram, a platform dedicated solely to pictures, or Facebook, Tumblr, Twitter, and many other similar sites with user-generated content, both written and visual. This digital culture also thrives on speed and conciseness, which are two features that emojis excel at. In the "age of rapid chatter," how *Wired* journalist, Clive Thompson (2016) aptly calls it, rather than waste precious moments trying to accurately convey one's feelings, users only have to pick which emoji best sums them up and press send.

In an early paper from 2007, I discussed the prevalence of English as the language of the Internet. Almost 10 years later, despite the diversification of languages when it comes to operating systems or applications, on international boards and groups, English prevails. It is not, however, a literary, Oxford English, but a rather broken one: the English of memes, of computer games and computer gamers, a stultified English proliferated by the Internet, on sites such as 9gag, where it thrives. Unsurprisingly, the more serious the Facebook page, the fewer emojis are employed, for instance on Grammarly, one of the staunchest champions of literary English on Facebook.

In this context of broken English and visual culture, it should not come as a great surprise how easily social media users adopted emojis as means of expression. It should not come as a great surprise that expressing feelings and thoughts became a small picture. The ultimate simplification.

The emoji contains both the seeds of evolution and of involution. Worriers fear that, in the existing ripe conditions, we are witnessing the demise of written English. Linguists, however, are pointing out that communication solely through emojis is akin to communicating through grunts and gestures (McCulloch, 2016). It cannot be a self-standing language. But it does add an important visual dimension when attached to written language.

Recounting a conversation with a friend when, overwhelmed with how much she should have written, she responded with a single emoji, Alice Robb (2014) contends that emojis allow us to communicate without actually saying anything, saving people from having to actually spell out their feelings. This brings us back to the idea of communicative conciseness. Other observers of the emoji phenomenon point out that a single emoji is no longer enough, especially when there are so many to choose from (Clark, 2014). It is this very wealth of options that may have actually led to people stringing up several emojis to express more complex emotions. I myself use them, some times as stand alones, most often as accompaniment to text. In accordance with the 9gag/Grammarly dichotomy, the more serious the post on Facebook, the fewer emojis I used.

One of the most knowledgeable scholars in all matters emoji, Tyler Schnoebelen, who wrote his PhD thesis on the subject, has analyzed millions of posts on Twitter, called tweets, and has noticed a pattern emerging from the chaos. For instance, emojis tend to appear at the end of a written message (Steinmetz, 2014). The following example comes from Instagram, a pictures-only platform, where unsurprisingly users heavily employ emojis in the captions to their posts, as well as in their comments. I have cropped the screenshot to just the caption below the original picture of a dog and two of the comments that were offered by the application, in order to illustrate this rule.

Figure 2: Emojis on Instagram, at the end of a written message

When emojis are used within longer phrases, they often appear after separate ideas, or sentences, acting almost like a punctuation mark (Steinmetz, 2014):

Figure 3: Emojis on Instagram, within a message

Moreover, Tyler Schnoebelen discovered that in communication with the help of only emojis, utterances tend to fall into two main categories: they are either thematic or they respect a brief linear narration (Steinmetz, 2014). The thematic emoji are nicely illustrated by the three accompanying the first sentence in the Figure 3. All three are connected: the first, being obviously the pasta emoji, the second, the leaf emoji may be interpreted as basil, a common condiment to pasta, the third emoji, the wine glass, suggesting that the pasta is enjoyed together with this alcoholic beverage. Other, more classical examples are the Happy Birthday string of emoji (the cake, present box and the fireworks, a variant of which can be seen in *Figure 2*) or the Christmas string (the Santa, the Christmas tree, and the present box emojis).

The linear narration that Tyler Schnoebelen observed can be accurately illustrated with this example of a love story:

Figure 4: Linear narrative love story

As opposed to the thematic arrangement of emojis, here the order is important in order to get the narrative across: boy sees girl, boy likes girl, boy falls in love with girl, girl refuses boy, boy is sad, boy cries, boy drinks wine/alcohol. Scrambling the order would lead to a completely different story. The first emoji, the straight face, represents the “stance,” the user’s general attitude about the rest of the phrase/story, much like Scott Fahlman’s emoticons :-) or :-((Thompson, 2016).

These are some of the reasons prompting observers to wonder weather we are undergoing a gradual return to the pictorial languages of the past. Visual communication is not new in human history. Egyptian hieroglyphs, Chinese ideograms, and as an expert in visual language, Neil Cohn (2015) points out, comic books, as more a contemporary example, are just some other avatars of human, visual communication.

Vyvyan Evans (2015), a professor of linguistics also takes a look at emojis as opposed to written language, showing how the former fulfill the same functions as the latter, namely to convey ideas and to influence the attitudes of others. Talking about the symbolism of written language as opposed to the iconicity of emojis, he also demonstrates that it is not all black and white: some written English is based on iconicity, for instance onomatopoeia like “buzz,” “splash,” “bang,” “vroom.” At the same time, he shows how emojis can act symbolically despite their very pictorial nature.

Neil Cohn (2015) again goes even further by purporting that we have nothing to fear from emojis because, in order for them to become a true language, they would need grammatical rules. Moreover, they lack flexibility due to their limited vocabulary. Users cannot make up new emojis; that power rests with the Unicode Consortium. As a result, users are forced to limit their communication to a list, which might explain the need to include several in a string.

At the other end of the spectrum is the opinion that what makes emojis so popular is the fact that they are open-ended, open to interpretation, since we mentioned earlier their symbolic traits. For instance, the leaf emoji in *Figure 3* which can be interpreted as basil, or the opening sentence to *Emoji Dick*, in *Figure 1*, “Call me Ishamel.” Perhaps the most notorious flexibility of emojis is embodied by the controversial eggplant emoji, or the taco emoji, both of which having an additional vulgar connotation, so much so that, at least for a period, Instagram banned the eggplant hashgtag from its search option (Highfield and Leaver, 2016). A superficial search performed on September 7 2016, shows how most Instagram profiles with the eggplant emoji in their name and description are associated to pornographic content.

After studying all these points of view, it becomes clear that what people are worried about when they speak of emojis being the death of written language is the fact that for the sake of conciseness and out of convenience, digital users will increasingly prefer to choose from a limited number of fixed options. Herein lies the danger to language. The pinnacle of human expression, and literacy, is in fact the ability to convey a wide range of emotions through written language, words rather than pictures. When you choose an emotion from a list, or at least you try to approximate one, it is exactly this linguistic richness that may end up being eroded, the ability to tell the difference between “dismayed” and “distressed.”

As already mentioned and easily proven by a brief glance at content on Facebook and Instagram, digital communication does not belong to literary English. The more broken it is, the more it needs nuances to get the meaning across. This means that that for the foreseeable future emojis are here to stay and provide that service.

3. Conclusion

This paper has endeavoured to show how emoji language has evolved from Internet English and digital communication’s emphasis on conciseness and speed of reaction in a predominantly visual, digital culture. As to it becoming a new language, various linguists and journalists have shown that at the moment emojis are quite rudimentary. However, human language has known pictorial stages in the past, so the fact that emojis have appeared in the already discussed circumstances of our digital culture might be considered a natural progression. But will their apparent simplicity sound the death knell for written languages? Most likely not. As linguist Gretchen McCulloch (2016) observes:

“It’s not that emoji are killing the English language — they couldn’t if they tried. But it may be that a language that people are not putting emoji next to — that’s a language that’s in trouble.”

Which means that, in the digital land of speed and conciseness, us, thumbfolks (Thompson, 2016) will inevitably prefer to “emoji” rather than “laugh with tears of joy.”

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Figures Source:
Figure 1: https://aviewonculture.wordpress.com/2014/05/18/emoji-dick/, accessed September 3, 2016
Figure 2: Mobile phone screenshot, Instagram, captured September 6, 2016, personal archive
Figure 3: Mobile phone screenshot, Instagram captured September 7, 2016, personal archive
Figure 4: http://time.com/2993508/emoji-rules-tweets/, accessed September 3, 2016

Work is the key to success, for both students and teachers

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Abstract

M(athematics) = T(heory) + E(xercices) + E(xercices) + E(xercices) + . . . is the motto of the webpage that generates infinite number of core mathematics exercises, for middle schools students

Keywords: Practice, Mathematics

1. Use technology to support learning

As teachers, we don’t only provide knowledge, but also try to reach the heart of the children. These go often close one to another, and to achieve it we use all the resources that we can get. Technology is one of them.

Nowadays we rarely meet a student that has not his own mobile phone, his own computer / laptop or other Tech-gadgets. They spend more time with technology than with their pairs. Why not try to use technology to serve our purpose?

First attempts to use technology to connect with student was a Facebook web page, in which I - teacher, could post information, facts, data, files that the pupils would read and use. This is still in use, with a good rate of accesses.

Another attempt was creating a Facebook group. This is more permissive both for teachers and students. The group connects teachers and students. Everyone can post, can reply, can upload and download files and all is viewed by all members. This is also in use at the time being and is appreciated by both teachers and students.

These are great for communicating with students, for transmitting news/events that we were not able to transmit in time at school, for communicating between teachers, even for offering student’s support in learning. It often happened to me to be asked through Facebook some clarifications for certain lessons. It is more than rewarding to know that you can help the students even being away from them.

As far as for enhancing learning and mathematic skills I had to find something else. Being a math teacher, I always dreamed about differentiated learning environment, where every student would learn and practice at his own pace. I had a good idea of how I could improve students’ capabilities in math. I was planning to build a web site that would provide infinite number of basics exercises for students, to train their basic math capabilities. Of course in order to do that I needed a web space that would allow me to program / to code the content. There were not few attempts to build a website, but it took longer to find a provider that allowed me to insert coded lines into the web page.

2. Basic JavaScript code

As well as in sports, mathematic skills are most of the time acquired by hard work and practice. My idea of this web page was that every student that needs to practice, could access the wanted topic and practice lots and lots of exercises or problems at his own pace, without having exercises that would repeat, without having the same exercise as his colleague - if they were working in the computer lab.

An usual web page, designed using html script, is only offering the right to post text, pictures, movies, files but is not changing content according to the user's action. Programming the web page was the solution to that, only programming is not doing by itself, so I started to learn. The closest solution for me was learning JavaScript and add parts of JavaScript coding into the web pages html text. Those parts would assure the interaction betweenany user and web page, would generate different and almost infinite number of exercises, would assure the individual practice for each student.

During the summer of 2014, in the same process of finding an internet provider that allows using scripts, I started to learn how to make web pages interactive with JavaScript.
A basic html script with a JavaScript part included is looking like this:

```
<html>
<head>
. . . title to display in title bar . . .
</head>
<body>
. . . content to display in web page . . .
</body>
<script>
. . . JavaScript code (not displayable, but ensures the interactivity computer - user) . . .
</script>
</html>
```

First step was to learn how to make the page aware of what the user would type as an answer. So I learnt about different types of input of data and I programmed additions and subtractions of positive whole numbers. I was very excited to see that the page was reacting accordingly and this gave me the power and willing to go further.

I structured the mathematics curriculum of middle school students into 12 algebra chapters and 12 geometry chapters, then each chapter was divided into units and further, into operational math skills. I posted all this plan at http://proflorin.weebly.com/curriculum.html.

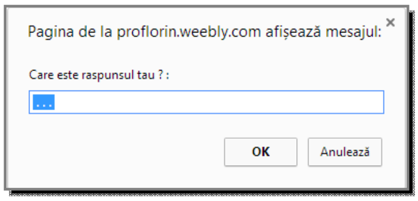
I started then to pick skills one by one and think how I would like to see it on the screen, if I were a student. Then I searched the means to put this in practice. I spent hours to search references on Internet, mainly on http://www.w3schools.com, then adapt it to my needs, then check if the code was responding for numberless trials.

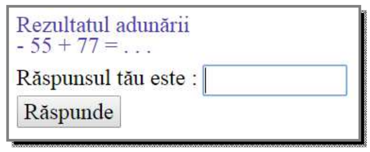
The impact that the use of the page had to students was more than satisfactory. Students were no more stressed out by the teacher - each exercise was provided by the computer; they were having fast feedback of their work, on each exercise; they were working at different pace and by the number of exercises that they solve, the better skill they have.

3. Better JavaScript code

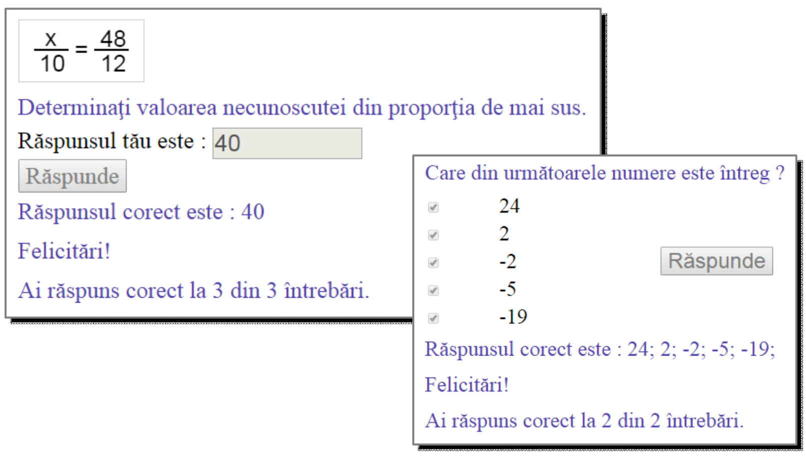
First access of students to the page was made in the computer lab, guided by me. This gave me the certainty that they are in the right place/ right page, that they work properly and also that they would know how to access it again from home.

Working from home came with surprises. Not all students benefits of a home computer, or they have their own smartphone or tablets with Internet access. This came with a new challenge. They showed me that the way I coded so far was a bit frustrating for those who have phones or tablets, because of popups. So I had to look for a way to
take off the input of the answer by popup and learn how to use a text input box.



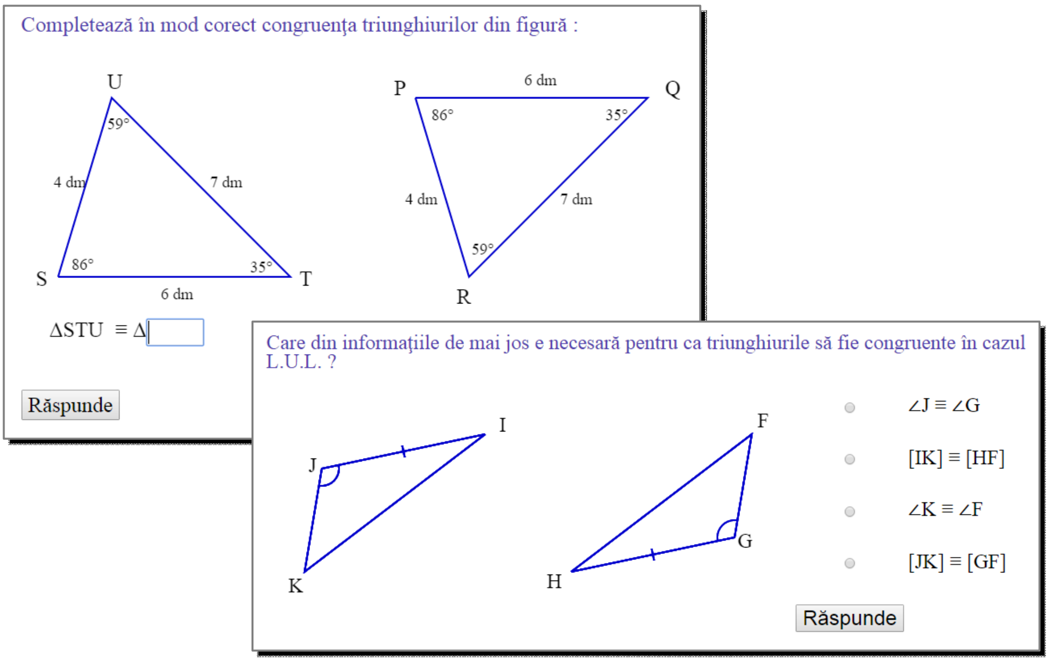


Another suggestion for improvement was to enlarge the feedback offered to students, not only regarding the solution to the questions, but also concerning the number of correct answers given. This was not easy to make, because each time an exercise was renewed, it was like a new web page, with a new code running. I had to use something that was not new, that was not changing, and that was the host computer. This leaded me to learn about cookies and use it. Students can see now, after many responses, how many of them are correct out of the total number or exercises they tried. It leads them to be more responsible when they answer to each question, in order to have as many correct answers out of the total number of questions.



Even if programming each page, each particular mathematic skill takes long, sometimes even some days, I like the effect it has over my students and it keeps me going on. Starting programming algebra skills was the first step to do, because it was not involving any graphic design, but mathematics is not resuming only to algebra. In the summer of 2015 I spent more time in searching and learning about graphing with JavaScript and also about embedding GeoGebra applets into JavaScript.

Graphing with JavaScript sent me to learn about “canvas” and “lines” in a system of coordinates. Also I needed to learn about combining graphing and JavaScript variables that work behind it.

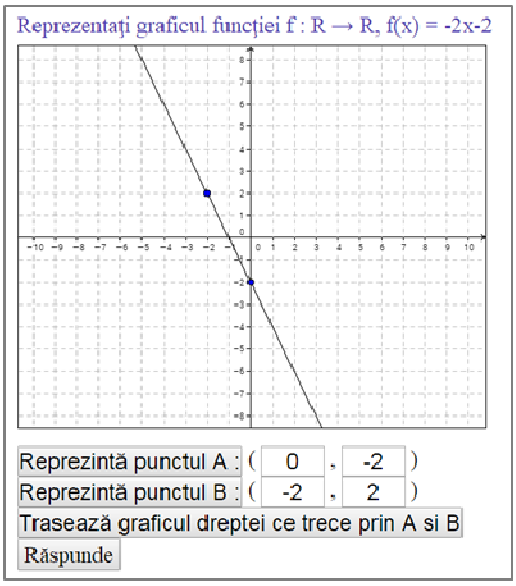


Embedding GeoGebra applets into JavaScript was even more challenging, as it has to match variables that were working into the JavaScript with variables that were working into the GeoGebra application.

GeoGebra is an application for mathematics, but not only, written in Java. That is why its content can be combined with JavaScript.

I managed to combine GeoGebra applets and JavaScript into the Graphing chapter.

All pages built so far were and are used by students, either in class or at home. Not only one of them said that he/she is more confident in solving exercises since we started to use the math web page. Another student, after being sick absent for a couple of days, once he came back to school and worked in the computer lab, he managed to catch up the class during one single hour.



All students need to work hard, either in class or at home, to master the mathematics skills they need. I designed and created the page for basic skills, for all middle school students, no matter if they work in class or at home. It is far from being complete, so I need to work even harder now to achieve further students' needs.

4. M = T + E + E + E + . . .

The name of the page: "Mathematics = Theory + Exercises + Exercises + Exercises + …" emphasizes the need to work hard in order to achieve your goals.

In the subpage "About" any user will find four messages delivered through Voki. Messages are dedicated to all people that access the page, are explaining facts about the site.

The subpage "Curriculum" is dedicated to the 24 mathematics chapters and to all students that want to practice.

"Supliment" provides links to other math sites, either created by teachers or by organizations.

"Discuţii" is dedicated to forums, and "Contact" offers a way to communicate with me or my school.

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LET's Learn English with Technology

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Abstract

The paper looks at our experience as teachers, of English and ICT respectively, in designing a MOOC for English language learning. LET, the acronym for Learning English with Technology, is the title of the massive open online course we are proposing to beginners who are looking for digital and online means of learning English as a foreign language. While adding content to this MOOC, we encountered certain challenges, such as: what are the best software for language acquisition, how can one accurately evaluate the progress made by learners, or how to facilitate interaction between peers, to mention just a few.
Including multimedia, digital, and online elements in the language-learning process definitely has numerous advantages, but this article focuses more on the decisions that have to be taken and the challenges that have to be met when building a MOOC for language learning.

Keywords: MOOC, English Language, learning

1 Introduction

With all the changes brought about by the digital revolution, the technological trend was bound to catch on to education, too. One of the most interesting online phenomena is represented by online courses open to a big number of participants (Jansen and Daniels, 2016), in short MOOCs (Massive Open Online Courses). MOOCs are courses designed for large numbers of participants, that can be accessed by anyone anywhere as long as they have an internet connection, are open to everyone without entry qualifications, and offer a full/complete course experience online for free (OpenEd, 2016).

As opposed to "traditional" online courses which incorporate videos, various reading materials and/or sets of exercises, MOOCs do not have specific requirements for those who wish to enroll. MOOCs can include different forms of assessment and interactive forums, where participants can communicate with each other and with the tutors in charge of the respective courses.

In recent years, it has become even clearer that MOOCs have the potential to revolutionize education. But are MOOCs suitable for teaching any subject? For instance, is this type of online course appropriate for second language teaching and learning? The present paper aims to analyze this question. After looking at the literature available on the topic and reviewing the LMOOCs (Language Massive Open Online Courses) currently offered by the already established platforms (such as Coursera or FutureLearn), we will present the challenges we have encountered while designing an LMOOC. Our course is a MOOC for beginners in English, which is why we called it Learning English with Technology (LET).

2 Are MOOCs a viable alternative in the learning process?

The term MOOC first appeared in 2008, but it really developed on the scene of online distance education in 2012. This was called by specialists „the year of the MOOCs" due to the fact that several well-financed providers, such as Coursera, Udacity or edX, affiliated to some top universities, appeared (Sandeen, 2013; Ying, Jinlei and Baohui, 2013, Giuntini and Venturini, 2015).

Moreover, MOOCs have the potential "to disrupt the way higher education is organised and delivered", with important impact on aspects such as teaching practice, quality assurance, accreditation, learning analytics, business models, and concepts of openness, success and completion (Jacoby, 2014).

Since 2008, this form of e-learning has constantly gained in popularity. After 2013, the MOOC phenomenon simply exploded, the number of MOOCs growing exponentially. At the moment, MOOC providers are continuing on this ascending path and are developing real ecosystems. Only in October 2016, 1800 MOOCs are starting, more than 200 being new (Shah, 2016).

The MOOCs on offer cover a wide range of fields: Art & Design, Business & Management, Computer Science, Education & Teaching, Engineering, Health & Medicine, Humanities (with subfields as (Learning) Languages & Cultures), Mathematics, Personal Development, Programming, Science, or Social Sciences, as specified by the MOOC Class Central portal (https://www.class-central.com/subjects), other portals or platforms defining similar categories. In 2016, the first four fields of interest continued to be Business & Management, Science, Social Sciences and Computer Science, as revealed by the Class Central reports.

A lot has been written about the **advantages** of MOOCs, so in what follows we only mention some (Conole, 2015; Xia, 2015; McIntyre, 2016a; Chengjie, 2015):

- the opportunity for organizations to close partnerships with universities well-known around the world;
- most MOOCs offer free (or extremely affordable) knowledge to all those who want to enhance their knowledge and skills and thus adapt to the requirements of the ever-changing job market;
- there are no pre-requisites (McIntyre, 2016) or formal admission criteria;
- MOOCs are usually offered by prestigious universities, so their content is going to be of high quality;
- in general, MOOCs are interactive and integrate videos, articles, discussion forums, social media tools and different types of exercises. However, each course has its own specificity;
- MOOCs have a high degree of flexibility, although they are organized according to a structure and they bring together a community sharing the same interests. On the other hand, some MOOC platforms offer sets of courses to master a subject in depth, packed as Nanodegrees (Udacity), Specializations (Coursera), XSeries and MicroMasters (edX) or Programs (FutureLearn);
- learners who meet the basic criteria of participation get a certificate and those who finish all the online assessments get a certificate of competence. A delicate problem remains the fact that most employers do not yet acknowledge these certificates;
- until recently, most universities did not assign transferrable credits for the completion of a MOOC. But some higher education institutions have started partnerships with the largest MOOC platforms in order to provide courses with transferrable credits. Although such programs are not free, the costs are substantially lower than those for academic courses.
- high accessibility and huge variety of topics;
- the majority of MOOCs are in English, French or Spanish, which means that participants will study certain subjects and practice their language skills at the same time.

Researchers have spotted some **disadvantages** as well (Yanfeng, 2015; Xiong & Wu, 2015; Haywood and Macleod, 2014):

- participants do not get credits (just a certificate of completion or competence);
- MOOCs are still unavailable to people who do not have Internet access or cannot understand the language in which the course is delivered;
- because of the big number of students, it is impossible for instructors to evaluate everyone's work; if automated tests are not created, peers have to evaluate each other, which raises doubts and controversies;
- in fact, teacher-student interaction is virtually absent, also due to the large numbers of participants;
- low rates of graduation;
- sometimes, the information offered for free is limited, so in order to learn more, students have to pay certain taxes;
- synchronous communication is difficult to achieve, because of time zone differences and work schedules;

Other critical comments, formulated by universities, include: „sanctioning edutainment", „unprofessional teaching methods", and turning higher education into a „corporation" (Zemsky, 2014; Jaschik, 2013).

3 MOOCs in Romania

In 2013, there were only very few reactions from representatives of Romanian universities regarding this form of education. Currently in Romania there are many initiatives related to MOOCs:

- implementation of platforms and MOOCs (http://mooc.ro, http://unicampus.ro, http://novamooc.uvt.ro, http://unibuc-virtual.net, http://udemy.com/management-ong, http://estudent.ro, http://eliada.ubbcluj.ro/proiect); no MOOC is for language learning, the topics are related to teacher training, engineering, management or social skills;
- experiments for integrating MOOCs in blended academic courses can be found at the Politehnica University of Timisoara and the University „Ioan Slavici" of Timisoara (Holotescu et al., 2014; Vasiu and Andone, 2014);
- workshops and national conferences on open education organized by the Romanian Coalition for OERs.

4 Exploring Language MOOCs (LMOOCs)

Language literacy is an essential life skill for the 21st century, providing access to information, easing communication and collaboration, helping in keeping pace with the ongoing changes of the knowledge society, and in obtaining a professional advantage in labor market as they facilitate the access to multilingual resources. Moreover, exploring other languages and cultures is an efficient way to acquire multiple skills like social skills. But how easy is to cover the linguistic needs of a big number of people who aim to live and work efficiently in the global community? Massive Open Online Courses (MOOCs) are a promising solution to this problem: due to their openness and flexibility, MOOCs seem to be a great choice for contemporary autonomous learners, for learning and practicing of foreign/European languages (Perifanou et al., 2014).

When we speak about languages and MOOCs, we can note two aspects: one is the language in which the course is developed and offered, and one refers to the course topic, if it is related to learning a foreign language, culture and civilization; in both cases the (thousands of) participants can have a large number of native languages. For this article, we will refer only to MOOCs for learning a foreign language - Language MOOCs (LMOOCs), in our case English.

Yet, for LMOOC developers, things are not always clear-cut. How should they address a diverse, heterogeneous public? What materials, activities, and tasks can be added, so that they are suitable for various age groups, cultural backgrounds, or professional paths? Moreover, those who enroll in such a course have different reasons and purposes. If we think of beginners who take up an English MOOC, some might register because they want to find a (better) job, others need some basics to get around on a holiday, whereas others desire to become fluent/proficient/articulate. And this doesn't even begin to cover the wide range of learner intentions and needs.

We could mention the large category of MOOCs for learning English provided by FutureLearn in collaboration with British Council, Open University, or other prestigious partners (https://www.futurelearn.com/courses/categories/languages-and-cultures). Some of them deal with continuing professional development for English language teachers, preparing them to teach participants with different levels of English proficiency, such as "Teaching your subject in English", "Exploring the World of English Language Teaching", or "Teaching for Success: Lessons and Teaching". In May 2015, the largest MOOC ever - "Understanding IELTS: Techniques for English Language Tests" - was run for 440,000 learners from 150 countries, having as motivation to improve English (80%), to learn new things (47%), and to prepare for further studies (44%) (FutureLearn, 2015).

The Coursera platform comes with a large category of English LMOOCs too (https://www.coursera.org/browse/language-learning). There are specific specializations for English-teaching strategies, such as "Teach English now! Technology Enriched Teaching", "English for Teaching Purposes", or "Shaping the Way We Teach English". "Interacting with students from around the world is one of the most enriching aspects of learning on Coursera. For teachers, this means exposure to an entirely new base of educators to collaborate and gain strategies from." (Coursera, 2014).

A catalogue of LMOOCs was realized by Martín-Monje and Bárcena (2014), containing the courses on the market at that time. Their list was not that long, even though they took into account all the second language learning MOOCs, not only those aimed at people willing to study English. They found that most of the existing MOOCs are quite specific, with topics like business English, or improve the writing in English.

In the same year, Perifanou and Economides (2014) have found too that the number of LMOOCs was relatively small. Only 16 such courses met the dimensions they consider essential for an efficient LMOOC:

- Content (check for: authentic educational resources, use of multimedia, variety of activities that promote all basic language skills);
- Pedagogy (check for: communication, collaboration, autonomy, engagement and motivation, game-based learning, number of instructors);
- Assessment (automated, instructor, peer-peer, open; is there a final assessment? is feedback provided for ongoing and final evaluations?);
- Community (integration of social media and other tools in order to enhance community building);
- Technical infrastructure (number of participants, security, performance, usability);
- Financial issues (charges for certificate, accreditation).

Their research has shown that most of the LMOOL initiatives are based on the cognitive behavioral pedagogical model (xMOOC type) and don't promote "a highly interactive environment where the learners are interconnected to a language learning community and build collectively their language skills". Although most language courses of this type are still free, have a good infrastructure, and offer some form of certification, designers and educators should focus on improving the pedagogical aspects of their LMOOCs.

Learning a language is an extremely complex endeavour, involving thousands of exercises, long hours of practice, and a lot of individual effort. Therefore, some reasons why not many LMOOCs have been developed so far may be:

- not enough exercises (how many to be practiced/solved before you allow the participants to move on to the next level?);
- not enough time (MOOCs typically end after a few weeks);
- no follow up (?);
- no or little interaction with a tutor (pronunciation, grammar, lexical subtleties require feedback from a language teacher, a peer may not be better prepared than the other students to answer these inherent problems);
- too little interaction with peers (not enough authentic communication in the target language); peers are not natives, so there is basically no one to correct their possible mistakes;
- grammar drills, reading comprehension, listening tasks might work, but speaking and writing need feedback;
- learners lose motivation if their learning needs are not covered;
- conversations take place on threaded discussion platforms.

Maggie Sokolik (2014), facilitator of the edX "Principles of Written English" (MOOC averaging approximately 50,000 participants per five-week segment of the course), stresses how important the instructor's presence is in an LMOOC. Practically he/she facilitates community building, keeps up students' motivation, clarifies certain problematic issues. Therefore, ideally, the platform hosting the LMOOC should allow for:

- self-organization (users should have the option to create groups or follow other users);
- voice/video posts (authentic language materials, an opportunity for students to become engaged in culture as well as the language itself they are studying);
- users to be able to see when instructors and facilitators are online and available for contact;
- lessons adapted to online teaching (attention span is shorter);
- structured peer assessment (but peers should be trained by an instructor - rules should be read and understood by them) - many disadvantages;
- structured self-assessment (auto-scored multiple choice);
- informal peer feedback (on discussion forums) leads to learning in social context.

In the same study, the steps to be followed when creating an LMOOC are highlighted (Sokolik, 2014):

- placement test;
- realization of tasks (study course material, explore resources and other material they find on their own, produce artefacts and interact with peers, thus they create knowledge in a social context);
- teacher presence is created through the learning guide, the detailed instructions for the tasks, the introductory videos for each topic and a weekly feedback message, based on the information prepared by the support team. One or two synchronous sessions (Google Hangout, web conference, etc.) during the course, preferably with one or several relevant guests, should be used to increase teacher/teaching presence, and strengthen the social ties in the learning community;
- resources: mainly OERs, other free online material and participants' artefacts;
- different versions of the same task (for different levels); authentic tasks; also some extra tasks for those who want to achieve more;

- feedback: self-correct, peers, teacher;
- credits: e-portfolio presented by the participants (50%), combined with a final, face to face exam (50%).

A combination between an xMOOC format (tutor-centric) and a cMOOC format (supporting connectivist autonomy) would be desirable when designing a language MOOC. The cMOOC format places "its emphasis on interaction and community building", qualities which are important for language learning (in the communicative approach, the focus is on enabling the learner to use the second language in authentic contexts), thus not suitable for beginners, though (they have to navigate the medium, acquire a big amount of information rules, vocabulary, sometimes even a new alphabet - and then have to communicate in the target language with peers who are in the same situation). In this case, the "medium of instruction is the medium of communication", in a language they are not familiar with.

xMOOCs are similar to the traditional classroom (there is an instructor, a syllabus), but Siemens (2012) said they only encourage "knowledge duplication". However, when it comes to learning a new language, repetitive tasks and drills are probably still necessary - before you can communicate, you have to know basic verbal forms, for example. But interaction is vital to achieving the main goal of language learning, which is to be able to have a conversation despite the fact that your grammar is not perfect.

More than that, LMOOCs should be designed to make use of developments in technology that have the capacity to help solve inherent challenges in language education (Adams et al., 2016):

- data-driven technology - information that can be derived from learning analytics;
- informal learning - to engage in authentic and meaningful interaction with peers;
- mobile learning - ubiquitous opportunities and access to apps and speech-to-speech translation tools that support on-the-go learning;
- immersive technology - online games, virtual and augmented reality that simulate real situations.

5 Discussion: Own initiative to run an LMOOC

A major part of the NOVAMOOC project is the building and running of our own pilot / prototype Language MOOC. We decided to host the LMOOC in the cloud, on a free and flexible external platform (Teachable). One thing that we pay attention is to have a successful pilot LMOOC, which to be assessed and accredited by the Ministry of Education, so that the West University of Timisoara, Romania (WUT) becomes the coordinator of some digital learning centers in Romanian speaking spaces (including diaspora, Moldova etc.). Our aim is twofold: to integrate our LMOOC in the university educational strategy and to increase the institutional online visibility.

In the table below we have selected a few strong and a few weak points of MOOCs in general and we have tried to see whether they verify for language MOOCs. We would like to stress the fact that we are focusing on language MOOCs for beginners who want to study English.

MOOCs		**LMOOCs for beginners**	
Strong	**Weak**	**Strong**	**Weak**
free/low costs	no credits	x	X
no pre-requisites	big number of participants		X
interactive (integrate video, etc.)	assessment (automated, self, or peer)	x	X
community/collaborative learning (shared interests)	little/no teacher-student interaction	x	X
flexibility, learner autonomy	big dropout rates	x	X
accessibility	inaccessible to those who do not have Internet access	x	X
lifelong networked learning		x	

6 Thoughts at the end

The big obstacle in designing MOOCs comes from the “massive” numbers of potential participants, and language learning raises other specific challenges as well. For example, the need for oral interactions (teacher-student, student-student), or the need to practice certain structures several times, in different types of exercises, before moving on to the next level. The constant need for feedback from an instructor is a challenge that is very hard to deal with. Synchronous communication is difficult on a MOOC (Skype, Google hangouts); social media sites and applications can be used, but what if the teacher is only available when you are at work or the peers you were supposed to talk to at a certain hour can’t/don’t access the Internet or even drop out of the course meanwhile? Moreover, beginners could only practice some constructions learned beforehand since they lack the lexical knowledge that would allow them to communicate in authentic, unplanned situations.

The fact that students create their own Personal Learning Environment, where they manage their learning process (publish their work, communicate and collaborate with peers) is an advantage. Digital inclusion is another plus. The interactive nature of MOOCs, access to OERs and updated information, render such courses more interesting and motivating. In a globalized, technologically connected world, “the focus in language education (…) is no longer on grammar, memorization and learning from rote, but rather using language and cultural knowledge as a means to communicate and connect to others around the globe.” (Eaton, 2013).

Moreover, we would like to personalize the LMOOC in the context of the Romanian cultural space, issuing certificates and formal university credits as possible. For WUT students, these courses will be free, for the others the costs will be lower than the usual courses which have accreditation. It is an important challenge, but we are at the beginning of this adventure, and we are still trying to figure out what MOOCs will be successful in the future. That is the ultimate goal of the NOVAMOOC project. If we achieve it, we believe we can become innovators of the Romanian educational system, challenging universities to rethink their strategies in order to maintain competitivity. This effect of liberalization and opening of education will represent a real change in Romanian higher education.

At the same time, we aim for WUT to become a pole of career development, by supporting students / participants in our courses to acquire relevant knowledge for today’s world and to consolidate their feelings of self-worth.

The quality of the NOVAMOOC project and its results is a key parameter for its success. The MOOCs developed within the project will meet all the quality requirements (design, content and presentation) and, for this reason, they will be validated by organizing some **pilot learning labs**. These labs will take place in WUT and they will enroll at least 150 participants, students from all fields; in the spirit of the MOOC definition most used in the European educational space, 148 – the Dunbar number - is considered the minimum number of participants in a MOOC (OpenEd, 2015). The labs will be organized during the current academic year and the results will be used for improving and validating courses.

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