QED'16:

Technology Advanced Quality Learning for ALL

Selected papers

June 13-15, 2016
Sofia, Bulgaria

QED'16

June 13-15, 2016, Sofia, Bulgaria

UNESCO International Workshop

QED'16: Technology Advanced Quality Learning for ALL

COMPILED AND EDITED BY:
Eugenia Kovatcheva and Natalia Palikova

Publisher: ЗА БУКВИТЕ ОПИСМЕНЕХЪ ...eneh,

2016, Sofia, Bulgaria

Organised by

United Nations
Educational, Scientific and
Cultural Organization

UNESCO Chair on ICT in Library Studies,
Education and Cultural Heritage,
State University of Library Studies
and Information Technologies (SULSIT), Bulgaria

Under the Patronage of the Bulgarian National Commission for UNESCO

nd with the financial support of:

- the Erasmus+ Project 2014-1-BG01-KA203-001561
- Project with partial funding of scientific event sponsored by Decree № 3 of Ministry of Education and Science: PPFSE-2016-05

COMPILED AND EDITED BY:
Eugenia Kovatcheva and Natalia Palikova (SULSIT)

Cover and Artistic Design: Eugenia Kovatcheva

ISBN 978-619-185-261-1 - online, published on http://unesco.unibit.bg/

ISBN ISBN ISBN 978-619-185-260-4 – paper version

Publisher: Za Bukvite, O'Pismeneh,

Sofia, 2016, Bulgaria

PREFACE

The present book reflects contributions (articles and presentations) to the UNESCO International Workshop *QED:* ***Technology Advanced Quality Learning for ALL,*** held in Sofia from June 13-15, 2016.

The QED workshop was organised by the *State University of Library Studies and Information Technologie*s (SULSIT), Sofia, Bulgaria.

The workshop was a regional event as a follow-up of the EDUSummIT 2015 Research-informed strategies to address educational challenges in a digitally networked world, September 14- 15, Bangkock, Tailand and

The event was hosted by SULSIT which is a unique (in Bulgarian context) research and educational interdisciplinary center integrating studies in the library science, digital technologies, cultural and historical heritage.

It has been successfully implemented and has achieved multi-direction positive results and impact. Useful ideas and practices have been discussed, which will continue to be built up and used in the future including the following ones:

- to establish fora and communities of practice for cross-stakeholder ICT in Education communication
- to develop and establish a repository of open ICT in Education best practices
- to summarise the general ideas, contributions and outcomes of the QED'16 workshop and to submit an article based on it to EDUsummIT'15
- to propose new topics to EDUsummIT'17, e.g. related to the *upbringing,* and the *language barriers*
- to collect feedback from the participants in the workshop
- to extend the teachers' sessions in terms of participation
- to start teacher education master programs in ICT with IITE
- to translate in Bulgarian the framework of UNESCO for IT in education
- to provide pieces of advice to policy makers to adapt their strategies for ICT in education according to the best world practices;
- **to bring it back EDUsummIT'17 to Europe (namely – in Bulgaria)** as discussed with its former coordinators Joke Voogt and Gerald Knezek.

Although presented in a condensed form here the contributions reflect the main ideas conveyed by their authors at the QED workshop and they will hopefully serve as an inspirational source for further work towards advancing education into the digital age.

Roumen Nikolov
Eugenia Kovatcheva

Contents

QED'16 organisation

Organised by the *UNESCO Chair on ICT in Library Studies, Education and Cultural Heritage*, State University of Library Studies and Information Technologies (SULSIT), Bulgaria

United Nations Educational, Scientific and Cultural Organization

UNESCO Chair on ICT in Library Studies, Education and Cultural Heritage, State University of Library Studies and Information Technologies (SULSIT), Bulgaria

with the financial support of:

- the Erasmus+ Project 2014-1-BG01-KA203-001561
- PPFSE - 2016 – 05 project for partial funding of scientific event sponsored by Decree № 3 of Ministry of Education and Science

Programme Committee

Honorary Co-Chairs:

- Blagovest SENDOV, BAS, Bulgaria

Co-Chairs:

- Alexander KHOROSHILOV, UNESCO IITE, Russian Federation
- Roumen NIKOLOV, SULSIT, Bulgaria

Scientific secretaries:

- Evgenia SENDOVA, BAS, Bulgaria
- Elena SHOIKOVA, SULSIT, Bulgaria

Members:

- Ana Lúcia TERRA - Escola Superior de Estudos Industriais e de Gestão - Instituto Politécnico do Porto, Portugal
- Ahmet ALTAY, Kırklareli Üniversitesi, Turkey
- David GIBSON, Curtin University, Australia
- Dessi PANEVA-MARINOVA, Bulgarian Acadamy of Science
- Eugenia KOVATCHEVA, SULSIT, Bulgaria
- Georgi TOTKOV, Plovdiv University Paisiy Hilendarski, Bulgaria

- Gerald KNEZEK, University of North Texas, USA
- Irena PETEVA, SULSIT, Bulgaria
- Ivan GARVANOV, SULSIT, Bulgaria
- Ivan IVANOV, SULSIT, Bulgaria
- Ivanka PAVLOVA, SULSIT, Bulgaria
- Ivanka YANKOVA, SULSIT, Bulgaria
- Joke VOOGT, Amsterdam University, The Netherlands
- Kwok-Wing LAI, University of Otago, New Zeeland
- Margaret COX, King's College London, UK
- Milena Krumova, Technical University-Sofia, Bulgaria
- Petra FISSER, National Institute for Curriculum Development, The Netherlands
- Radoslav YOSHINOV, Bulgarian Acadamy of Science
- Radoslav PAVLOV, Bulgarian Acadamy of Science
- Rosa Doran, NUCLIO, Protugal
- Rositsa DONEVA, Plovdiv University Paisiy Hilendarski, Bulgaria
- Serap KURBANOĞLU, European Association for Library & Information Education and Research, Turkey
- Slagjana JAKIMOVIK, Sts Cyril & Methodius University, Republic of Macedonia
- Stoyan DENCHEV, SULSIT, Bulgaria
- Tania TODOROVA, SULSIT, Bulgaria
- Vadim GRINSHKUN, Moscow City Teacher Training University, Russian Federation
- Vladimir RADEVSKI, South East European University, Republic of Macedonia

Organising Committees

Honorary Chair
- Gergana PASSY, Digital Champion Bulgaria

Co-Chairs:
- Stoyan Denchev, Rector of SULSIT, Bulgaria
- Peter Kenderov, BAS, Bulgaria

Deputy Chair:
- Irena Peteva, SULSIT, Bulgaria

Members:
- Eugenia Kovatcheva, SULSIT
- Tania Todorova, SULSIT
- Tereza Trencheva, SULSIT
- Bella Tetevenska, SULSIT
- Katerina Mahmudieva, SULSIT


УНИВЕРСИТЕТ ПО БИБЛИОТЕК


QED'16: UNESCO International Workshop
Technology Advanced Quality Learning for ALL
The workshop will be hosted by the State University of Library Studies and Information Technologies (SULSIT). The organiser is the UNESCO Interfaculty Chair ICT in Library Studies, Education and Cultural Heritage at SULSIT.
Panel 1
Creativity in a Technology Enhanced Quality curriculum
Assessment as, for and of learning in the 21st century
Advancing mobile learning in formal and informal settings
Panel 2
Professional development for policy-makers, school leaders and teachers
Smart partnerships
Addressing Gaps and Promoting Educational Equity
Panel 3
Indicators of quality technology-enhanced teaching and learning
Digital citizenship and cyberwellness
Curriculum – Advancing understanding of the roles of CS/informatics in the curriculum
UNESCO
United Nations Educational, Scientific and Cultural Organization
uniTwin
БИТ
UNESCO Interfaculty Chair ICT in Library Studies, Education and Cultural Heritage State University of Library Studies and Information Technologies, Bulgaria
The Workshop is under the Patronage of the Bulgarian National Commission for UNESCO.
UniBIT - 2nd building
69A Shipchenski prohod, blvd
Opening 9.00, hall 309, UniBIT-2
Registration 8.30 - 9.00
June 13-15, 2016, Sofia, Bulgaria
QED'16

WORKSHOP Agenda

June 13 , 2016

9:00 - 9:30	Registration	
9:30 – 10:00	**Opening – room 309** Moderator Roumen Nikolov	
10:00 - 10:25	*Joke Voogt* Professional development for policy-makers, school leaders and teachers	
10:25 – 10:50	*Margaret Cox* Curriculum - Advancing understanding of the roles of CS/informatics in the curriculum	
10:50 – 11:20	Coffee break	
11:20 – 11:55	*Alexander Khoroshilov* With ICTs Towards the Goal of "Education-2030": Challenges, UNESCO Approach and IITE Experience	
11:55 – 12:20	*Rosa Doran* Changing the world teacher by teacher: a wave towards 21st century skills	
12:20 -12:45	*Roumen Nikolov, Elena Shoikova, Milena Krumova, Eugenia Kovatcheva, Velian Dimitrov and Alexander Chikalanov* Learning in a Smart City Environment	
Parallel Sessions	**Educational Technologies** *Moderator Elena Shoikova - room 5*	**Digital Libraries** *Moderator Tania Todorova - room 6*
14:00 - 14:15	*Orlin Kouzov and Daniela Pavlova* Unchain the education through mobility	*Ahmet Altay, Tania Todorova and Ivanka Yankova* The Public Library Services in Turkey and Bulgaria: Comparative Findings and Recommendations
14:15 - 14:30	*Vladimir Radevski, Arben Hajra and Fidan Limani* Semantically Related Data as Technology-Enhanced Support for Research Assistive and Quality Tools	*Alexandra Kumanova, Nikola Kazanski and Nikolay Vasilev* Rhizome of the Humanitarian Knowledge in the Secondary-Documentary Information Modelling of the International Universal Bibliography in 20th-21st centuries
14:30 - 14:45	Silvia Gaftandzhieva, Nikolay Kasakliev and Rositsa Doneva Mobile Application for Learning Quality Evaluation	*Elisaveta Tsvetkova* Mobile digital libraries in Bulgarian information space

14:45 - 15:00	*Boyan Jekov and Petya Mihaylova* Indicators of quality technology-enhanced teaching and learning	*Sabina Eftimova and Elena Ignatova* Management of innovation processes in the university library
15:00 - 15:15	*Valentina Terzieva, Petia Kademova-Katzarova and Rumen Andreev* Technology Enhanced Teaching in Bulgarian Schools - Teachers' View	*Toni Chehlarova, Radoslav Yoshinov, Monka Kotseva* Teachers Support Planning for applying of ICT in Education
15:15 - 15:30	*Dobri Boyadzhiev and Pepa Petrova* New aspect of implementing network certification study program in public higher education programs	*Toni Chehlarova* A Didactic scenario for a mathematical performance

16:00 – 16:15	*Iglika Getova* Smart Learning in 21st Century - Trends and Effectiveness	Workshop - *room 6* Moderator: *Toni Chehlarova* *Good practices in mentoring high school students on doing research*
16:15 – 16:30	*Kristina Varbanova-Dencheva* Models for the Creation and Exchange of Educational Content – approbation of e-learning platforms in ULSIT	
16:30 – 16:45	*Zhanat Nurbekova, Nurgul Tokzhigitova and Gulzhan Jarassova* Ensuring quality education based on multi-criterial approach	
16:45 – 17:00	*Marya Gyulemetova* Model for Stable Developments	

June 14, 2016

09:30 - 09:55	*Petra Fisser* Creativity in a Technology Enhanced Quality curriculum	
09:55 - 10:20	*Kwok-Wing Lai* Advancing mobile learning in formal and informal settings	
	Parallel workshops	
10:50 - 13:00	School on the Cloud Moderator: *Eugenia Kovatcheva room 1*	Innovation Practice in Education Moderator: *Milena Koleva room 5*

Parallel Sessions	**Applications** Moderator: Oleg Konstantinov - room 5	**Student Session** Moderator: Eugenia Kovatcheva - room 6	**Workshop:** room 1 Moderator: *Georgi Gachev*
14:00-14:15	*Oleg Konstantinov and Valeria Fol* The Sacred Spaces in Bulgarian Part of Strandja Mountain – an Interactive Multimedia Product	*Natalia Palikova and Eugenia Kovatcheva* Applying Computer games as an Instrument to Stimulate Creativity in the Scientific Research Process	*Good practices in mentoring high school students on doing research*
14:15-14:30	*Alexander Nikov User Experience Design of eLearning Workplaces*	*Iliya Vukarski and Yavor Rusinov* What are "Smart cities" and what are the costs of their implementation	
14:30-14:45	*Georgeta Nazarska and Svetla Shapkalova* Use of Electronic Resources in Teaching Religious Heritage in Higher Education: Best Practices from the SULSIT, Bulgaria	*Oleg Kuschnikov, Elena Kuschnikova and Leonid Filimonyuk* Development of a mathematical model predicting software systems failures in critical situations	
14:45-15:00	*Mariela Nankova* The role of ICT in Cultural Heritage education	*Oxana Nass, Alman Kushekkaliyev, Gaukhar Kamalova, Aidana Jumagaliyeva and Aidana Sultanova* Computer support of project method	
15:00-15:15	*Mayiana Mitevska-Encheva* Comparative analysis of the dominant leadership styles and personality traits in Technology Advanced Quality Learning in Bulgarian universities	*Nikola Tomov and Eugenia Kovatcheva* Customisation of the content management system for distributed visualisation	

15:15-15:30	*Zhanat Nurbekova, Kymbatsha Mukhamediyeva, Almagul Assainova, Gulbarshyn Nurgazinova and Kuat Rizahmetovich* Teaching robotics at the pedagogical higher educational establishment: Kazakhstan experience	*Oxana Nass, Aidana Jumagaliyeva and Aidana Sultanova* Requirements to the electronic educational resources
15:30-15:45	*Zhanat Nurbekova, Gulmira Abildinova and Bakyt Nurbekov Curricula Designed Technology*	*Alexey Zaslavsky* Didactic potential of different types of cloud technology

June 15, 2016 – Round Table

10:00 - 13:00	**Forthcoming EDUsummIT'17**

WELCOME SPEECHES
(in Bulgarian Language)

- From the Host Institution – Rector of the University

От името на домакините: проф. Стоян Денчев – ректор на УниБИТ

За мен е изключителна чест и удоволствие от името на Ректорското ръководство на Университет по библиотекознание и информационни технологии и на Организационния комитет да Ви приветствам с „Добре дошли!“ на Международния семинар на тема ***QED'16: Технологии за модерно качествено образование за всички!***

Организиран за трети пореден път от нашия университет чрез Катедрата на ЮНЕСКО *„ИКТ в библиотечните науки, образованието и културното наследство“* – настоящото издание е посветено на 60 години РБългария в ЮНЕСКО и се провежда под патронажа на Националната комисия на ЮНЕСКО. Съорганизатор на форума е Институтът по информационни технологии в образованието на ЮНЕСКО със седалище в Москва. Сред нашите партньори и съмишленици са и г-жа Гергана Паси, Дигитален шампион на България и Основател на Дигиталната национална коалиция (ДНК) в България, Институтът по математика и информатика към БАН, РААБЕ – България, проект Action Project for Innovation

Сърдечно приветствам чуждестранните експерти проф. Александър Хорошилов от Института по информационни технологии в образованието на ЮНЕСКО в Москва, проф Йоке Вухт (Амстердамския университет, Холандия), проф. Kwok-Wing Lai (Център за дистанционно обучение и образователни технологии, Нова Зенландия), проф. Маргарет Кокс - King's College London, University of London Великобритания, проф Петра Фишер (Университет на Твенте) и Rosa Doran – Galileo – програма за обучение на учители от Португалия, като и всички български участници – университетски преподаватели, учители, изследователи, експерти и практици, както и гостите на форума!

Международният семинар ***QED***, посветен на качеството на образованието с ИКТ, се провежда като регионално събитие, свързано с Глобалните срещи на високо равнище *EDUsummIT,* които се организират с подкрепата на ЮНЕСКО на всеки две години от 2009 г. до днес. Настоящият форум е свързан със Срещата на високо равнище *EDUsummIT'15* (Банкок, Тайланд), в рамките на която се взема решение следващият *EDUsummIT 2017,* да се проведе в България през месец септември, 2017 г. с домакин УниБИТ. Това е изключително признание и възможност за международно позициониране на страната ни в тази много важна за нашето и в глобален аспект развитие област.

Убеден съм, че чрез разнообразните формати за научно и професионално общуване, включени в семинарните дни - тематични панели с доклади и презентации, паралелни сесии с представяне на добри практики, дискусии и съпътстващи работилници - всички присъстващи ще открият интересни общи теми и нови перспективи за сътрудничество!

Пожелавам ползотворни и творчески семинарни дни на всички участници и откривам работата на Третия международен семинар на тема ***QED'16: Технологии за модерно качествено образование за всички***

KEYNOTE
PRESENTATIONS & PAPERS

Professional development for policy-makers, school leaders and teachers

Joke Voogt

University of Amsterdam, The Netherlands

Abstract

Continuing professional development for all actors at all stages is critically important if education is to be transformed through the application of information and communication technologies (ICT) (Voogt & Knezek, 2008). Successive EDUsummIT meetings have included working groups on teacher professional development (TPD) for the application of ICT in education, thereby recognizing the importance of effective TPD for successful implementation of ICT into the education system at all levels, from preschool through secondary schools, to higher education and teacher education. Nevertheless, there remains much work to be done to ensure that TPD meets the needs of teachers across a wide variety of contexts and cultures.

Lack of suitable professional development may exacerbate the digital divide between and within countries and even within individual schools (Anderson, 2010) if it results in ineffective application of ICT (OECD, 2015). Still, although, access to ICT is a prerequisite, it does not inevitably bring about 'better' learning outcomes. It remains true that what teachers do with whatever (little) ICT is available has greater impact on learning than the mere presence of ICT.

Development of an appropriate ICT Competency Framework for Teachers may assist countries to develop effective policies and standards within a master plan for ICT in education (UNESCO, 2011). EDUsummIT 2011 highlighted the importance of achieving a shared vision of ICT implementation and supporting its realisation by engaging all stakeholders in decisions about TPD, promoting networks and communities for TPD, and including ICT as an integral component of TPD (Twining, Raffaghelli, Albion, & Knezek, 2013). Following EDUsummIT 2013, a conceptual model linking research with practice was developed with illustrative cases of key principles applied in different parts of the world (Albion, Tondeur, Forkosh - Baruch, & Peeraer, 2015). The main themes addressed during EDUsummIT 2015 were : (1) the importance of contextualization; (2) the challenge of sustainable and scalable TPD; (3) the question how to link TPD for ICT integration to educational innovation; and (4) systemic and systematic TPD. Finally, TWG3 also introduced a new concept in this field: 5) technology discernment.

Curriculum - Advancing understanding of the roles of CS/informatics in the curriculum

Margaret Cox

Kings College London, UK

Abstract

At EDUsummIT 2015 it was argued that the major rationale for including Computer Science as a subject in the K-12 curriculum are economic, social and cultural. The economic rationale rests not only on the need for a country to produce computer scientists to sustain a competitive edge in a world driven by technology but also on the requirement for Computer Science-enabled professionals in all industries to support innovation and development. The social rationale emphasises the value in society of active creators and producers rather than passive consumers of technology. Such capability provides people with power to lead, create and innovate within society and therefore is also an issue of entitlement to "powerful knowledge" (Young, 2013) giving individuals opportunities to choose their role in society. The cultural rationale rests on enabling people to be drivers of cultural change rather than having change imposed by technological developments.

In this brief paper we explain firstly the background to recent curriculum changes and the global context in which they are taking place. Then we explain the issues and challenges for establishing and maintaining the roles for Computer Science in curricula for K-12. Next we present solutions and recommendations for policy makers, educators, industrial partners and researchers and finally we outline our actions for taking forward these solutions.

Creativity in a Technology Enhanced Quality curriculum

Petra Fisser

The Netherlands

Abstract

A key focus at the Thematic Working Group 6 on Creativity in a Technology Enhanced Curriculum at EDUsummIT 2015 in Bangkok, was on building an understanding of areas of intersection of creativity and technology in teaching and learning, and identifying ways that creativity can become more deeply integrated into technology-rich curriculum for teachers and students within developed and developing contexts. A main part of the rationale for this lies in the vital role that creativity plays as a principal driver for much of the growth, development, and new innovations that have occurred throughout human history and society, as well as the increasing need for it to address problem solving and learning in our complex world.

Contemporary technologies provide new and powerful ways for individuals and groups of individuals to be creative –and it is important to give consideration to how these opportunities fit within a 21st century framework for education.

Advancing mobile learning in formal and informal settings

Kwok-Wing Lai

University of Otago, New Zealand

Abstract

During the Fourth International Summit on ICT in Education (EDUsummIT, 2015) which was held in Bangkok, Thailand, members of the Thematic Working Group 2 (TWG2) discussed methods, strategies, and guidelines for some of the issues and challenges in the design, implementation, evaluation, and policy development of mobile learning. Some major key challenges were highlighted and discussed along with issues that policy makers, teachers, researchers, and students are facing in mobile learning. Based on the outcome from the framework that identified barriers and limitations along with dynamic criteria for mobile learning implementation, which was the outcome of TWG2 from the EDUsummIT 2013 (Khaddage et. al., 2015), the group briefly summed up major challenges and identified possible solutions that could be applied to solve these challenges.

The implemented framework classified challenges into four categories: Pedagogical challenges, technological challenges, policy challenges and research challenges. Any new technology leads to new pedagogies, new policy and new research; these four factors combined can form a solid infrastructure that may help adopt effective ways of mobile learning application (refer Khaddage et. al., 2015 to read more about the model). All evolutionary change usually takes place in response to ecological interactions that operate on the overall ecosystem, and in this case the interaction is obvious between these four challenges and they can allow the understanding of the structure and function of each one of them. Understanding the relationships between these challenges are essential for a proper mobile learning integration and a successful mobile learning ecology (Zhao & Frank, 2003).

Mobile learning as a concept and theory has evolved rapidly, it is no longer considered technocentric (devices and technologies), it is more about the learner's mobility and how we as educators can engage them in learning activities without them being wirely restricted to a physical location. Hence comes the challenge of finding appropriate and effective methods to blend formal and informal learning as seamless learning can occur anytime, (formal in-classroom, or informal outside classroom).

PRESENTATIONS & PAPERS
(in English Language)

Unchain the education through mobility

Orlin Kouzov[1], Daniela Pavlova2

[1]Ministry of Education and Science, Sofia, Bulgaria

[2]State University of Library Studies and Information Technologies, Sofia, Bulgaria

okouzov@mon.bg *d.pavlova@unibit.bg*

Abstract

The modern education is mobile and ubiquitous. Tendencies show gradual increase of time that people spend with their personal mobile devices such as tablets and smartphones, which gives ground to the reasonable assumption that education should gradually go mobile, utilizing much higher potential of the modern social and technological ecosystem. Educational institutions, governments and companies need to reconsider seriously their middle term strategies for encouraging mobile education, which is becoming one of the most influential phenomenona of the 21st century. The penetration of successful learning practices through mobile devices coincides with the social understanding that the education should be "unchained" from the formal school and academic environment and be multiplied successfully in cyberspace using cloud technologies and distance learning methods. Bulgaria is not neglecting these processes. In the National Strategy for effective implementation of information and communication technologies in education and science in the Republic of Bulgaria (2014-2020), adopted by the Council of Ministers in July 2014 one of the key elements is opening up of education and science environment to mobile devices (m-learning) and encouraging students to use their own equipment. This is fully in line with the concepts of life-long learning and universal knowledge access, which are the key pillars of the so called knowledge economy. As currently the above cited strategy is in its second stage called Mobility and Security (2016-2017) it is the proper time to analyse and react to the challenges and opportunities for mobile education both in formal and informal settings. The task is not so trivial due to the bursting development of mobile technologies and the respective social and market relations in the digital environment. The article shows some of the most intriguing aspects of mobile education and proposes reasonable strategy to „unchain" the users from traditional educational environment giving them much bigger flexibility, more opportunities and greater control on their personal development.

Keywords:

Mobility, Ubiquitous, Education, Knowledge

1. Introduction

Global technological changes affect all aspects of social and economic life, changing the way that people used to do business, take care for their

families or even entertain themselves. From transport to food industry, every branch or trend in most economic niches is under severe pressure by technology and these transformations are changing our social ecosystem on a daily basis. Presumably education should not be left behind and the need to conduct a reform in education is knocking at our doors. The challenges are in several directions – on one hand the bursting technological development and intensive global cooperation make advantages in science much faster and more radical than ever before. On the other hand – the ways to spread information have multiplied dramatically for the last decade. Now everyone could receive news or everyday knowledge on various topics through more than a dozen different channels – radio, TV, Facebook, mail, Google or other internet media, not to mention the traditional paper newspapers and magazines and most of the news nowadays are spread literally in minutes no matter which part of the world is affected, because of the global reach of Internet.

The third challenge is related to the new transformed labour market – the drastic socio-economic changes make some traditional knowledge totally useless and the need to adapt to the new environment – more intensive than ever before. In the past, people at least had some generic idea what they will need to learn during their 12-18 years learning cycle – the life was much slower, the necessary skills and knowledge were more or less preliminary defined and the needs of the labour market were generally predictable. Nowadays things are much different. Labour market is so dynamic and the changes so fast that even within a 4-5 year period the situation with the necessary labour skills could change dramatically and hundreds of new professions could appear, replacing the ones that were known for decades or even centuries.

Having in mind all these new aspects, it is not surprising that we start considering an education that is really flexible, adaptive and dynamic in order to fit to the new, fast changing reality and to match the skills learned to the needs of the society and the national economies.

2. Mobile environment and matching the needs with the opportunities

It is quite natural that in order to be flexible the education needs to go beyond the standard classroom boundaries. The life has become too dynamic and the need to be responsive to that increasing speed puts additional challenges before the man of the 21st century. People have to be constantly aware of the changes in the weather conditions, the road traffic, the political stability, the global warming, the financial crisis etc. and that enormous amount of fluctuating information requires totally new ways of reaching the individual and filtering the essentials, so information

technologies should help filling this gap. Nowadays almost all people in the modern world have their own smart devices (phones, tablets, laptops) and using them as a mainstream for information and content resources has become a natural behaviour. The development of wireless internet technologies (Wi-Fi, WiMAX, 3G, LTE etc.) is catalysing this process as the increased bandwidth of the handheld devices makes very easy streaming videos, watching TV, participating in teleconferences and groupware activities.

The man of the 21st century is mobile. The processes of globalization make much easier crossing national boundaries, online booking of hotels at exotic destinations, purchasing property abroad and teleworking… Nowadays people spend more time in travel than ever before and this time could be well utilized for self-training and acquiring new knowledge on the fly, using the opportunities, provided by mobile technologies and cloud ICT infrastructure. Following the concept of lifelong learning more and more people start understanding that the new learning model and necessities are well fitted to the new technological reality, so matching the opportunities with the needs is becoming a market phenomenon and mobile learners are one of the fastest growing groups in the upcoming economy of knowledge. As long as the technologies continue to develop rapidly, the whole system of education is expected to undergo dramatic transformations in the next 15-20 years, „unbounding" the learning process from the classroom and positioning it in the virtual knowledge environment, accessible from any place, at any time.

3. Mobile education and new habits

Mobile education leads to a series of changes in personal behaviour. First of all the boundaries between education and entertainment become blurred as people start receiving training and knowledge "on the fly" while reading their horoscope or the latest news from their smartphone. For them entertainment and education come from similar environment and sources and the concept that education is a fun becomes natural to many citizens especially in younger age, when they use their mobiles more often. We could consider that technology is the connecting point between formal and informal learning and follow the Sterling's [1] idea for encouraging passion „We are looking to see how we capture that energy and passion in school. Often when they move into school, the energy goes out of it. I think we have to find ways to capture that excitement and get them as engaged in school work as they are outside.

Second – the percentage of the informal knowledge rapidly rises compared to formal learning content as information channels that surround us are

from various origins and have no centralised management logic compared, for instance, to school education. More or less informal knowledge helps understanding better the formal one and according to Thompson [2] „Informal learning experiences outside school offer a potential bridge between social media and academic content".

Third – people start understanding that informal knowledge is sometimes as important as the formal one and even – more critical in certain occasions. More or less formal education is universal and directed to masses while informal one is quite individual and therefore – more fitted to the surrounding environment, needs and habits. If you are interested in sports it is quite likely that you'll spend bigger time with sports channels, if you are a music fan, then probably music portals will be your favourites etc. As a result of these changes people start using their mobiles as major source for information and advice and their role as "learning terminals" gradually replace the importance of the traditional classroom. In the past critical belongings for most citizens were considered money, documents, keys from the car etc. and people used to check for them when leaving home. Nowadays most people check for their smartphone first – it is used for making schedules, navigating the car, setting home alarm, reading news, making reservations… It is hard even to think about any meaningful social or economic activity that has still no mobile application or is not dependent somehow on the internet and the new ICT.

4. The role of institutions for encouraging m-learning

In the National Strategy for effective implementation of information and communication technologies in education and science in the Republic of Bulgaria (2014-2020) [3] adopted by the Council of Ministers in July 2014 one of the key elements is opening up of education and science environment to mobile devices (m-learning) and encouraging students to use their own handheld equipment. That is literally a great turnover in Bulgarian education because it is clear indication that government understands the role of new technologies and, having in mind the existing and potential market trends and overall development of information society, paves the road for expanding education outside traditional school environment. It is not quite right to say that education is exported from the classroom – a more precise statement should be that the classroom is already established in cyberspace due to the new mobile technologies.

The abovementioned Strategy is divided into three stages with the corresponding important results:

I stage. Key investments – short-term (2014-15)

- unified backbone network, connecting regional educational inspectorates, universities and science centers;
- national ICT cloud infrastructure for the needs of education and science;
- wireless (Wi-Fi) infrastructure in educational and scientific institutions;
- national digital education and study content management platform;
- pilot implementation of integrated management system at school and university level;
- education portal and digital handbooks for all sciences and mathematics subjects.

II stage. Mobility and security – middle-term (2016-17)

- permanent optical or high-speed connection with educational institutions;
- opening up of education and science environment to mobile devices (m-learning);
- integrated national education information and management system;
- digital platform for video-training, teleconferences and R&D;
- digital handbooks with interactive content for all general subjects.

III stage. Universality and sustainability – long-term (2018-20)

- unified education environment for ubiquitous learning (u-learning);
- transition to digital textbooks for all subjects;
- virtual classrooms and laboratories;
- national system for online exams and external assessment;
- open and universal access to education and science resources.

As the Strategy is in the second phase of its implementation, we could conclude that most characteristics of mobile education are already available in the country (education cloud, fibre backbone, Wi-Fi infrastructure) and since that is happening in the formal educational system, the natural assumption is that institutions are aware of the global market trends and development of technology. On the other hand mobile technologies have already penetrated so deeply in our daily life that formal and informal education are using the same communication channels, including personal mobile devices. More or less all future educational content must be available on the internet and as Britland says „It is time for all schools to embrace the cloud." [4].

Consequently the next trend in education will be the adoption of the necessary digital content to mobile device interfaces and the need for

purchasing computers for schools will decrease dramatically in the next 3-5 years because they will be no longer needed.

5. The new teachers – formal and informal settings

Despite the expectations of many supporters of technology that with the penetration of e-learning the role of the teacher will decrease, actually, things are quite different. In fact, the teacher will lose his/her role as a major source of information (Google will take care for that), but from other perspective the role of the teacher as a guide and spiritual leader in the avalanche of information will increase a lot. The teachers of the future will not share with their students just empirical data but their own vision and way to critically understand the facts that are considered. Most of the future education will be oriented to self-training and the work in class will be explicitly oriented to discussion and debate helping students understand the concept behind the facts and the logic behind the scientific results. The teacher will provoke students with questions and will expect from them not citation of facts that are available everywhere, but their critical analysis and own perception of the educational content. The future classroom will be more oriented to teamwork or debates and teacher will be no longer in the centre of the education process but students with their understanding of the surrounding environment. The teacher should help students express their own position and will encourage them to show their skills and vision in the process of discussion, helping them to acquire the necessary knowledge in a friendly and informal way, while debating with colleagues. According to Finley [5] there are several important characteristics of transformational teaching such as „… Have students ask questions and solve real-world problems. Questions should require students to:

- Analyze
- Synthesize
- Create
- Empathize
- Interpret
- Reference background knowledge

Defend alternative perspectives…"

The other important role of the teacher will be to inspire the student. In the past there were no criteria for measuring inspiration despite the practical assumption that motivated people could achieve much higher results. It is empirically known from teaching practice that the best teachers are not the ones that know most but the ones that succeed to inspire the students' curiosity and their desire to develop in the respective

subject area. Many of the current champions from school Olympiads confess that they owe a critical part of their successes to the teachers that encouraged them and raised their motivation to learn and progress in the respective subject area.

The new technology should not cut the linkage between student and teacher but will expand it to a new level in the virtual learning reality. Students in the future will be able to seek advice and support from their teachers not only in classes but in various situations and, as long as internet is available globally, they could keep their studying relations years after graduation.

There is an important role of the teacher of the future in the informal education as well. Nevertheless the teacher has no direct influence on all informal content that students meet in their everyday life, the approach learned (to analyse critically all facts and derive conclusions not taking anything for granted) is the merit of the new teaching concept and has long term impact on students in their future life, jobs and social relations.

6.Conclusions

The bursting technological changes provide opportunities for the development of a totally new educational approach related to the constant access to information and knowledge and the need for development of new skills for filtering and analysing the data. Knowledge and learning content are no longer in the centre of the schooling system but the student with his/her personal understanding, while the role of the teacher is no longer concentrated around the facts and the data but requires much more facilitator skills in order to help the students understand the lesson. The teachers of the future should not be just education and science professionals but spiritual leaders that are able to inspire and motivate students and give them the necessary momentum for developing interest in the respective subject area and make the necessary effort during their self-training hours.

References

1. *Sterling, R. (2008, April 29). Writing, technology, and teenagers. Kojo Nnamdi Show. Retrieved from the WAMU Public Radio Web site: http://wamu.org/programs/kn/08/04/29.php*

2. *Bull, G., Thompson, A., Searson, M., Garofalo, J., Park, J., Young, C. & Lee, J. (2008) Connecting informal and formal learning experiences in the age of participatory media. Contemporary Issues in Technology and Teacher Education, 8(2), 100-107.*

3. *"Strategy for effective implementation of information and communication technologies in education and science in the Republic of Bulgaria (2014-2020)", Retrieved from*

http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=904, Sofia, 2014

4. *Britland, M. (2013). What is the future of technology in education? The Guardian. Retrieved from http://www.theguardian.com/teacher-network/teacher-blog/2013/jun/19/technology-future-education-cloud-social-learning*

5. *Finley, T. (originally published: July 28, 2014, updated: July 23, 2015). 4 Things Transformational Teachers Do, George Lucas Educational Foundation, http://www.edutopia.org/blog/big-things-transformational-teachers-do-todd-finley*

Semantically Related Data as Technology-Enhanced Support for Research Assistive and Quality Tools

Vladimir Radevski[1], Arben Hajra[2], Fidan Limani[3]

South East European University Tetovo / Skopje – Republic of Macedonia

[1]v.radevski | [2]a.hajra | [3]f.limani @seeu.edu.mk

Abstract

The omnipresence and availability of digital resources attracts a huge application interest in the educational process. In this paper we propose approaches to support research and provide quality indicators by exploiting semantically related data.

The educational technology in general already offers variety of tips, guidelines and assistive tools covering various domains of the educational process. The idea elaborated in this work has to do with scholarly communication i.e. helping students autonomously and systematically approach new topics or area of interest, authors-related and discipline specific resources. Thus, if a student is interested in a particular topic, the first destination would be a digital library. We are looking at approaches that will automatically interlink several information about that resource especially providing topic, author or domain relevant additional resources - belonging to several repositories. In addition, the set of semantically related supplementary information can be enlarged with related scientific blogs, wikis, retried comments, ratings and views from social networks and web 2.0 services. These will not only facilitate the research process but can also foster the development of research and investigation skills to support students' ability for discovery and selection of online resources. The social aspect, partly represented via scientific blogs/wikis, remains an important component of libraries and other institutions that should be curate and provided to educators and researchers. In a typical scenario, the researcher would want to follow up with an up-to- date scientific blog/wiki in addition to the publication she is currently reading. This would eventually result in added value to her educational experience.

During the research assessment phase such interlinked tools can appear in the role of indicators for the quality and the completeness of the performed research and the quality of the results.

Keywords:

Digital Libraries, Semantic web, linked open data, author

1. Introduction

The omnipresence and availability of digital resources attracts a huge application interest in the educational process. Universities, libraries and other institutions (cultural heritage institutions, museums, etc.) offer a wide variety of assistive technology-based tools for teaching and

supporting creation and mobilization of research knowledge. In this paper we propose approaches to support research and provide quality indicators by exploiting semantically related data.

Several institutions and organizations are publishing their data in an easily consumable format, such as Linked Open Data [14]. Digital Libraries are leading by publishing entire catalogs or metadata in this fashion [5]. This represents a great potential for cross-linking and enriching a particular resource with other different relevant information. The educational technology in general already offers variety of tips, guidelines and assistive tools covering various domains of the educational process. The idea elaborated in this work has to do with scholarly communication, i.e. helping students autonomously and systematically approach new topics, authors-related and discipline specific resources [19]. Thus, if a student is interested in a particular topic, the first destination would be a digital library. However, diversity of information regarding that topic is often not accessible in one step. There are necessary several other clicks and navigations to other places for satisfying the search. Therefore, we are looking at approaches that will automatically interlink several information about that resource (using Semantic web approaches) - especially providing topic, author or domain relevant additional resources - belonging to several repositories [11, 12, 13]. In addition, the set of semantically related supplementary information can be enlarged with related scientific blogs, wikis, retried comments, ratings and views from social networks and web 2.0 services [16]. These will not only facilitate the research process but can also foster the development of research and investigation skills to support students' ability for discovery and selection of online resources.

During the research assessment phase such interlinked tools can appear in the role of indicators for the quality and the completeness of the performed research and the quality of the results.

2. Semantic Web and Linked Open Data Libraries and Resources

At present there is a large number of the Digital Libraries (DL), in different levels, as national, international, institutional, thematic, etc. Their usages bring a huge avail for the community and for scholars especially, with their global and simple accessibility.

However, in some cases getting the most relevant and qualitative resource using a digital library can be a challenge. Searching in a specific DL will result a list of resources, indexed and cataloged using a static metadata structure in that library. At the actual stage the scientific publications are being catalogued by trained professionals in a field or librarians. This

process leads to limitations in the literature search to a specific field – correspondingly catalogued and indexed. DL are noted as Monolithic Systems, where metadata describe the data rather than uses, and with limited and specific interoperability potentials. In addition – no additional information on the relevance, usability and quality of the retrieved resources is available. As a consequence, starting from a specific DL it is impossible or at least very difficult to cross the boundaries by spreading ones search in other resources. These characteristics are important issues when a student, a novice in a field or an experienced researcher wants to get an insight in a new research field, author's new publications or their relevance. Linked Data is about employing the Resource Description Framework (RDF) and the Hypertext Transfer Protocol (HTTP) to publish structured data on the Web and to connect data between different data sources, effectively allowing data in one data source to be linked to data in another data source [4, 14].

Various datasets are published on the web, under specific license or as public. Among others we can list Wikipedia, DBLP bibliography, Wikibooks, Geonames, FOAF, MusicBrainz, WordNet, German National Library and many more which are published under Creative Commons or Talis licenses [1, 3]. Also, Google, Yahoo, Microsoft (at schema.org), Facebook and others has agreed to publish structured data on the web.

The increased number datasets starting from June 2007 show the importance and the interest for publishing linked data. In September 2011, 295 data sets are counted in LOD cloud, consisting of over 31.6 billion RDF triples, which are interlinked by around 504 million RDF links. In August 2014 there are present 570 official datasets with billions triples, as part of cloud[1]. The most of datasets from this cloud belong to the Publication domain, Government, Media, Geographic, etc.

Comprehensive Knowledge Archive Network (CKAN) powers a number of data catalogues on the Internet, where each dataset contains a description of the data and other useful information [9]. Everyone can create a specific dataset: DataHub gives a visual representation of these datasets according to specific criteria, as total number, weekly revised, top rated, format etc [9].

Many important Libraries are offered as Linked Open Data, with ability to be noted inside the LOD and usable in our scenarios: German National Library (DNB), Swedish National Library (LIBRIS), British National Bibliography (BNB), Hungarian National Library (NSZL), Europeana Digital

1 http://lod-cloud.net/

Library, Library of Congress Bibliographic Records, ZBW - STW Thesaurus for Economics**,** DBLP Bibliography Database, Association for Computing Machinery (ACM), etc.

Our aim is to offer a service of a system where the search results would overcome the limitation of catalogues and indexation in a particular scientific domain and will take into consideration other scientific domains. The results should offer answers of the best ways to proceed in order to offer shared views on relevant literature - very often multidisciplinary by character, and thus allow discovery experience as well as search over variety of scientific areas and domains. This will provide a shift to the scholarly communication to a new level of connectivity among researchers fostering the dissemination, sharing and discovery processes.

The usage and interoperability with scientific resources offered as Linked Open Data can be a good track for reaching the goal; to enrich the library with recommendation from LOD. In this way, the aim would be to deliver web services which will automatically locate, identify and link up related resources from LOD primarily as a service for a novice in a specific domain.

The major research challenges of our interest include: Identifying relevant resources, Vocabulary mapping and identity resolution, Integration with conventional Library systems, Quality and User evaluation.

3. Cross-linked Approaches for Author's and Publication Profile Enrichment

A solution and implementation of the usage of LOD for discovering and constructing author's profiles shows the advantages of using this type of data [15]. Instead of looking author's websites and collecting information from several pages manually, the system can integrate the most relevant data about specific author using LOD repositories and represent them in an appropriate form.

As primary objective we focus on authors' correlations with other authors, other publications or additional bibliographic data which are not part of an initial DL. For each author from a repository a profile will be created which is extended with additional data found in other repositories. Conversely, the enrichment of search results in detail is described through author *name disambiguation*, *author identification* and *false authorship prevention*.

We consider bibliographic datasets offered from several libraries and institutions. Very promising is the data that are presented in the form of Linked Open Data (LOD), as part of the LOD cloud [4, 11, 14, 15]. As a test case, we will leverage the following repositories: German National Library

- DNB, Library of Congress - LC, National Library of France - BNF, National Library of Sweden - KB / LIBRIS.

At the core of this process lies the Virtual International Authority File (VIAF)[2], which in our case acts as a "bridge" to different repositories. Successful achievement of this process will help in accessing various repositories and collecting relevant information into a single place by enriching the profile of the authors inside a digital library. The main idea behind VIAF is to link authority files from several national libraries into a "super" virtual authority record - cluster. Currently, the most known national libraries maintain authority files on their own, which brings a distinctive way of preserving them [22]. The VIAF API can be used by anyone without the need of authentication. In addition, instead of API consummation we can refer to the VIAF LOD repositories. VIAF links disparate names for the same person by integrating authority files from 35 national libraries from 30 countries into a particular cluster. Each cluster is as-signed with a unique number, a VIAF ID. However, there are cases when VIAF clustering algorithm has issues, such as: several clusters for the same person, different people into the same cluster, incorrect bibliographic data and clusters with poor content [18]. Based on the results from [10] in a search of 283,114 names, 59% were not ambiguous, meaning that only one heading was found, 26% matched two headings, 10% matched three headings, 3% matched four and 2% more than four.

Our experiments are based on the *Econsto*[3] repository, the leading Open Access repository in Germany maintained by ZBW (Leibniz Informationszentrum Wirtschaft). For each author stored in the repository we search correlations with other authors, publications or other relevant information to them from several datasets. Hence, for each author in a DL we create a wider profile enriched by additional information. This will serve both, to enrich the search but also to solve author ambiguities by global identification of the same author written in different ways or same name referring to different authors.

The process of correct author identification in different repositories faces a challenge of author's name ambiguity, when determining whether two or more references correspond to the same person. For example, an author can be represented with different formulations in several bibliographic databases or different authors can share the same name, which gives a complexity to the data cross-linking process. Through

[2] http://www.viaf.org
[3] http://www.econstor.eu

Econstor ZBW offers a platform for Open Access publications to German researchers in economics.

Since the data in *Econstor* are represented as RDF statements - linked open data, we extend our interest to other bibliographic repositories in LOD cloud. The author name ambiguity remains to be the major obstacle for direct information retrieval about a given author from these repositories.

As an example, we would like ideally to find information about an *Econstor* author from other datasets. We often encounter cases when the same author can be presented with different variations in the wording of the name, such as: **Adam Smith; Smith, Adam; A. Smith-; Smith, Adam, 1723-1790; Смит, Адам, 1723; Smith. A.; Smith, Adam T. ; and Smith, Adam, 1930.** In addition, there could be different people with the name **Adam Smith**. A similar problem concerns the publications. The same title can be shown in different representations, in several repositories, such as missing some words.

The data cross-linking is based and initiated from the metadata that are used to describe the authors and publications in *Econstor*. On the basis of the metadata Name and Surname we create the set of all publications of a given author and a list of his co-authors (found as authors of the same publications). We consider VIAF as a "bridge" to cross different bibliographic databases. It is a challenge to detect accurately a particular author from a repository i.e. *Econstor*, and to connect this author with the corresponding author in VIAF. Achieving the right identification will facilitate the process of retrieving information from other datasets, especially from libraries that contribute to VIAF records, such as, DNB, LC, BNF and LIBRIS. We consider other publications that belong to a given author, correlations with co-authors, biographical data, publishers, etc.

The overview of the enriching process with additional information about the authors is given in Figure 1.

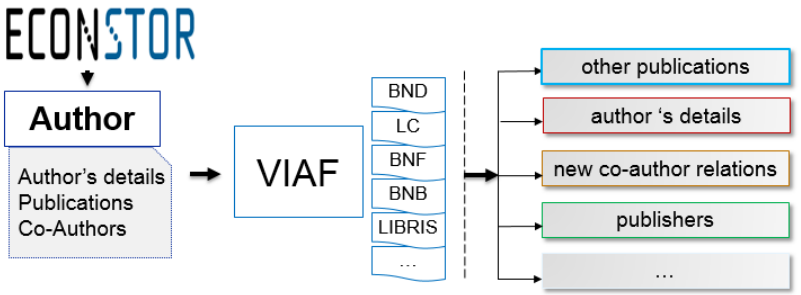


Fig.1. The overview of the enriching the authors' data with additional information.

We have established an automated way to check VIAF for a particular author and automatically determine the appropriate clusters. For each cluster found the VIAF ID is taken and assigned to the corresponding author locally in our database. In this way an author's profile is enriched and extended with additional information found in the cluster.

We use *Econstor* as bibliographical repository in these experiments. Since we are using the RDF dump file of *Econstor*, EasyRdf PHP library and rdf4j Sesame are applied for processing and storing RDF data. The current version of dump file has 1.635.599 RDF statements, 36.490 publications and 27.580 authors.

Let us consider a concrete example. Selecting a particular author from the prototype will result in appearing a list of all publications, co-authors and co-author's publications from that author. Similarities are found for the author's name, publications, co-authors and publications from the libraries that belong to this cluster. From the list of 6 publications found in this cluster, the prototype has highlighted three publications with 100% match with the publication in our database. Concurrently, in the cluster four co-authors of "*Kubler, Felix*" are found, who appear to be also co-authors in our database (Figure 2). Except these similarities, there are in total five libraries or institutions that contain this cluster, thus a possible exploration in these resources would endorse the match. In this way in the German National Library, a publication is found with

100% similarity. However this result is excluded from the calculation because the same publication appears in the cluster's publications. Overall, all these elements are significant proof that this cluster is correct for the author "*Kubler, Felix*".

For a performed search the number of retrieved results can vary from zero to some hundreds. The above example had only 6 clusters, with only one correct cluster. However, there are several cases where for one author can be zero, one or more than one clusters that really present him. In cases when at least one cluster is found, the VIAF IDs is saved in our local database, for each author.

We have analyzed 991 random authors from *Econstor* to VIAF and generated the evaluation metrics of recall, precision and F1 score. In our case, precision represents the fraction of the clusters that are retrieved as correct match. It is the fraction among the truly correct clusters (true positive) with all clusters that the system has retrieved as correct, including clusters that are retrieved as correct but are not (false negative).

The recall represents the fraction between the truly correct clusters with all correct clusters, including the clusters that are correct but the system has not identified them as such (false negative).

Based on the manually checked evaluations the system gives an overall precision of 98.1% and the recall of 95.9%. Thus, the efficiency of our system is measured with 0.970 as F1 score.

Each of these found clusters are manually evaluated for accuracy of matches. Based on these evaluations, very satisfactory results are generated. In the cases when an author is matched with only one VIAF cluster, we gain 98.8% precision, 95.7% recall and F1 score of 0.972. Thus the possibility for it to be the correct cluster is almost absolute. In the cases when two clusters are retrieved as correct match for one author, the precision is 95.7% and 97.2% recall, with F1 score of 0.964.

For each checked author from our repository, the corresponding found VIAF ID is stored locally. Grouping authors like this can be a huge benefit for clustering them inside a local repository and building a local authority profile for them. The found VIAF ID offers a permanent link to that cluster on the VIAF. After this, remains no need to conduct the process of identification over again. By having the right VIAF ID, all the relevant information found on the cluster are instantly retrieved, such as new publications and new co-authorship correlations.

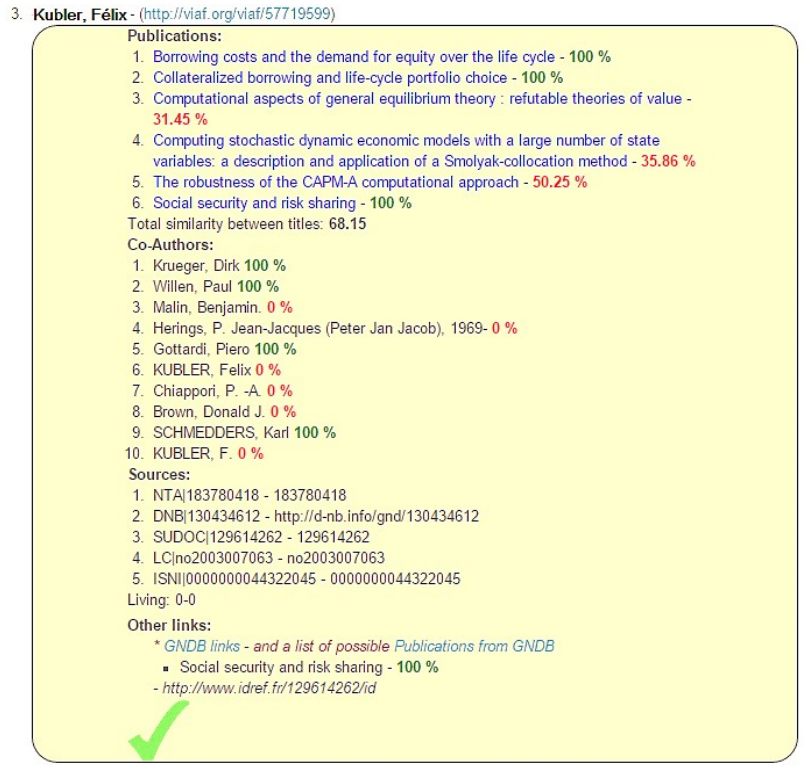


Fig. 2. Finding and evaluating as correct match an Econstor author with a VIAF cluster.

In addition, each cluster keeps in it the identification number of libraries or institutions that are contributing with content. We are considering these IDs as valuable information for extending the enrichment of an author profile. Therefore, by having that id, such as *13043612* for DNB, *129614262* for SUDOC, we can refer directly to these repositories to search that author. This can be done on different Web Services and APIs that these libraries offer, or by querying the LOD repositories. Most known libraries including DNB, LC, BNE, BNB, BNF, and LIBRIS offer their data or metadata as LOD in LOD cloud. Consequently, by performing a SPARQL query in these repositories, direct information retrieval is achieved.

The profile of an author as part of a digital library is enriched by wider list of information, including: new publications which are not part in that repository, new co-authorship correlations, publications of co-authors, possibility to cluster authors in the native repository, biographic information, i.e. birth year and Country and DBpedia content i.e. image, abstract and documents.

This leads to significant and automatic support of a search of a student or a novice in the works of a particular author and provides the necessary wideness of the scope of the working results of a researcher of interest.

4. Scientific Social Publications as Technology Assistive Entries

Social Web publications and resources are yet another emerging type of publication supporting the traditional teaching, learning and research practices. In the form of scientific blogs and wikis, they represent quite a natural venue for researchers to easily collaborate, follow each-other's research as it progresses, disseminate research findings, provide/receive feedback to/from the community they belong etc. [20]. In this sense, researchers propose more "social" teaching and learning environments, matching the changing practices in education. Libraries surely represent one of the first points that should accept this trend [9]. Although not a primary address for educators and researchers, scientific blogs/wikis provide a complementary role to the traditional research lifecycle [8]. The social aspect, partly represented via scientific blogs/wikis, remains an important component of libraries and other institutions that should be curate and provided to educators and researchers [6]. In a typical scenario, the researcher would want to follow up with an up-to-date scientific blog/wiki in addition to the publication she is currently reading. This would eventually result in added value to her educational experience.

It is via this type of publication that scholars present their ongoing research, discuss the latest scientific events, or follow and treat emerging developments [20]. This growing publication stream is proving too valuable to be left out from the traditional channel of research publications today. In response to user requirements, libraries are evolving towards a model of Library 2.0 [7,17] striving for more user interaction with their collections. The role and awareness of social web resources in the research workflow is examined as a support to the whole research lifecycle; more as a complement to the "mainstream" scholarly publication than a replacement [8]. Furthermore, integrating non-library resources (scientific blogs, in our case) with DL collections would allow for a seamless navigation across the resulting collection - library and non-library information resources [2]. In this regard, [6] sees the social component in DL - thus striving for a community- centered, "social DL" - as a viable path. This trend prompts to further explore the value that scientific blogs bring to the DL ecosystem and its users.

With over 150 million professional and amateur blogs in the blogosphere [21] collecting and disseminating science to larger audiences in a wide variety of domains - a significant and growing portion of which is

represented as scientific blogs, there remains a need for an efficient approach to make them accessible within DL environment. This is where our interest stems from: bringing scientific blog publications to DL users. Table 1 represents some of the features concerning DL repositories, scientific blog post collections, and controlled vocabularies of importance to our research context.

Table 1. Features of DL, Social Web resources, and Controlled Vocabularies

	DL Repositories	**Scientific blog post collections**	**Controlled Vocabularies**
Domain	Economics and related sciences.	Economics and related sciences.	Economics and related sciences.
Content type / Designation	Rich, qualitative collection of publications: conference articles and proceedings, journal articles, dissertations, books, etc.	Blog posts, featuring high user feedback in terms of comments, social web features (likes, shares, downloads, reads, etc.).	Thesauri, for resources indexing and retrieval.
Metadata presence	Yes. Highly structured and qualitatively curated, and based on a controlled vocabulary (such as STW in the case of EconStor and EconBiz).	Yes. Shallow controlled vocabulary in the form of tags (keyword descriptions). No (hierarchical) structure in place, alignment with existing vocabularies, or online visibility.	Thesauri, represented Descriptors and non-descriptors, in one or multiple languages, used in indexing and retrieving DL repository publications.
Semantic representation	Considerably so. (RDF/SKOS)	Not to a significant level.	Considerably so. (RDF/SKOS)

We aim to seamlessly integrate scientific blog collections to a DL ecosystem - which includes indexing this collection according to practices employed at the target DL - and enabling existing services from the latter treat the newly-added resources as part of the DL collection.

We are proposing a service that, initially, will match publication resources in these two different data repositories "types"; potentially provide new information on publications that could be of interest to the user or are related to the initial search without the user specifically requesting or knowing about it beforehand, as well as suggest new publications that might be of interest to the user – a recommendation service for scholarly publications.

This service will (a) help enrich the content of both DLs and scientific blogs and wikis by the mere fact that the user would seamlessly pool for publications in both repository types, (b) enable crossing the DL "boundary" by interlinking the different publications in both repositories types, (c) enhance the user search experience as the user will, ultimately, receive not only the added value from considering the two publication repositories, but also receive new insights and recommendations for new articles to consider, (d) allow users to engage more to the content as, especially on the side of scientific blogs and wikis – users will be able to comment, tag, share, etc, the publications of their interest, (e) bring more freedom to the users as they will have more choice in searching for publications of their interest.

5. Conclusion

We consider a case of support of a student, or a novice in a certain research field when searching to enlarge to resources about a given publication and author. Our aim is to provide an assistive tool to represent a Technology-Enhanced support for a guidance in the exploring the works of an author or a publication. The profile of an author as part of a digital library is enriched by wider list of information, including: new publications which are not part in that repository, new co- authorship correlations, publications of co-authors, possibility to cluster authors in the native repository, biographic information, i.e. birth year and Country and DBpedia content i.e. image, abstract and documents. Our work extends also in the area of bringing social web resources in the research workflow as a support to the whole research lifecycle, namely as a complement to the "mainstream" scholarly publication than a replacement – but in any case valuable added information for semi-guided or individual exploration of a scientific area of research.

References

1. *Auer, S., Bizer, C., Kobilarov, G., Lehmann, J., Cyganiak, R. and Ives, Z., (2007). Dbpedia: Anucleus for a web of open data pp. 722-735. Springer Berlin Heidelberg.*
2. *Baker, T., Bermès, E., Coyle, K., Dunsire, G., Isaac, A., Murray, P. and Zeng, M., Library Linked Data Incubator Group final report. [W3C Incubator Group Report October 25, 2011].*
3. *Bauer, F. and Kaltenböck, M., (2011). Linked open data: The essentials. Edition mono/monochrom, Vienna.*
4. *Berners-Lee, T., Hendler, J. and Lassila, O., (2001). The semantic web. Scientific american, 284(5), pp.28-37.*

5. Borgman, C. L. (2013). Digital Scholarship and Digital Libraries: Past, Present, and Future. 17th International Conference on Theory and Practice of Digital Libraries. Valletta, Malta.

6. Calhun, K. (2013) Digital libraries and the social web: scholarship. In Exploring Digital Libraries: Foundations, Practice, Prospects. London: Facet Publishing; Chicago: ALA Neal- Schuman.

7. Chad, K., Miller, P. (2005). Do libraries matter? The rise of Library 2.0. Talis whitepaper.

8. CIBER report. (2010) Social media and research workflow. University College London, Emerald Group Publishing Ltd.

9. CKAN-Data hub (Accessed May 18th 2016), Statistics, http://thedatahub.org/stats

10. Freire, N., Wiermer, R., Muhr, M., Juffinger, A., Latronico, C. and Charles, V., (2012). Author consolidation across european national bibliographies and academic digital repositories.

11. Hajra, A., Latif, A. and Tochtermann, K., (2014, September). Retrieving and ranking scientific publications from linked open data repositories. Proceedings of the 14th International Conference on Knowledge Technologies and Data-driven Business, ACM p. 29. ACM.

12. Hajra, A., Radevski, V. and Tochtermann, K., (2015). Author Profile Enrichment for Cross- Linking Digital Libraries. Research and Advanced Technology for Digital Libraries pp.

124-136. Springer International Publishing.

13. Hajra, A., Tochtermann, K. and Radevski, V., (2013). Enriching scientific publications with semantically related data. Balkan Conference in Informatics, BCI, p. 140.

14. Heath, T. and Bizer, C., (2011). Linked data: Evolving the web into a global data space. Synthesis lectures on the semantic web: theory and technology, 1(1), pp.1-136.

15. Latif, A., Afzal, M.T., Helic, D., Tochtermann, K. and Maurer, H.A., (2010, April). Discovery and Construction of Authors' Profile from Linked Data (A case study for Open Digital Journal). LDOW.

16. Limani, F., Radevski, V. (2013). Enrichment of Digital Libraries with Web 2.0 Resources for Enhanced User Search Experience. Proceedings of the 8th Annual South-East European Doctoral Student Conference. SEERC, Thessaloniki, Greece, pp. 294-300.

17. Miller, P. (2006). Library 2.0: The challenge of innovation. Talis whitepaper.

18. OpenID Foundation. Retrieved from http://openid.net/foundation/ (Accessed May 19th 2016)

19. Paepcke, A., Chang, C.C.K., Garcia-Molina, H. and Winograd, T., (1998). Interoperability for Digital Libraries: Problems and Directions. pp. 1–23.

20. *Powell, D.A., Jacob, C.J. and Chapman, B.J., (2012). Using blogs and new media in academic practice: Potential roles in research, teaching, learning, and extension. Innovative Higher Education, 37(4), pp.271-282.*

21. *Ranger, M. and Bultitude, K., (2014). 'The kind of mildly curious sort of science interested person like me': Science bloggers' practices relating to audience recruitment. Public Understanding of Science.*

22. *Virtual International Authority File. Retrieved from http://www.oclc.org/viaf.en.html (Accessed May 19th 2016)*

Mobile Application for Quality Evaluation of Learning

Silvia Gaftandzhieva[1], Nikolay Kasakliev[2], Rositsa Doneva[3]
University of Plovdiv "Paisii Hilendarski" Plovdiv/Bulgaria
[1]*sissiy88@uni-plovdiv.bg,* [2]*kasakliev@uni-plovdiv.bg,* [3]*rosi@uni-plovdiv.bg*

Abstract

Purpose: The paper proposes an alternative to the traditional way of conducting surveys within internal university systems for quality assurance using mobile technologies in order to increase the students' activity.

Design/methodology/approach: An analysis of the needs of internal university quality systems in conducting surveys as well as an overview of existing software tools for conducting mobile surveys have been made. After specifying the functional and non-functional requirements the mobile application for conducting surveys for the purposes of internal systems for quality assurance of higher education has been developed. Experiment for its application in specific surveys are conducted.

Findings: The developed mobile application allows conducting surveys within university systems for quality assurance and tools for authorized group of users that allow monitoring of the students' activity in surveys and automated analysis of the results.

Research implications: A solution relating to automation of the process of interviewing and summarizing the data in conducting surveys that are an integral part of the institutional quality assurance systems of universities is proposed. Thus the study supports the development of these systems in the direction of building a coherent European Higher Education Area.

Practical implications: The results of the study would certainly influence positively for improvement of practices for quality assurance in higher education institutions (see. Originality/value)

Originality/value: The developed and probated at Plovdiv University mobile application for conducting surveys is probably the first of its kind in the country. Its means for automated monitoring of the students' activeness as survey participants and for subsequent analysis of the survey results allow members of university quality committees to generate summary reports. But more over they could monitor ongoing surveys and analyse intermediate data at any time. The results of the presented research promise to be useful for the other educational institutions as well.

Keywords:

Mobile Applications, Internal Quality Assurance in Higher Education, Surveys on the Quality of
Teaching and Learning, Survey Mobile Application for Quality Assurance of Training in Higher Education

1. Introduction

High quality of higher education provides students with the knowledge, skills and competencies they need for their career. It is the basis for achieving compliance with the requirements of the labour market, improving employment and increasing economic growth. Quality assurance in higher education is a major component in the efforts to build a coherent, compatible and attractive European Higher Education Area (EHEA).

In this regard, the Bulgaria Higher Education law[4] requires universities to develop internal systems for evaluating and maintaining the quality of education. In conformity with the law, each university is subject to periodic external evaluation and accreditation by the National Agency for Assessment and Accreditation (NEAA) upon relevant criteria and regulatory procedures. According to the agency's criteria[5][6], each university must:

- periodically collect, analyse and use students' assessments and opinion of the learning
- process to enhance the quality of learning;
- conduct surveys among students about the appropriateness and efficiency of the teaching and assessment methods;
- discuss and present the efficiency of the results related to the management of educational quality;
- conduct and analyse surveys on each learning course and teacher as well as an annual survey with graduate students;
- conduct surveys with graduate students in order to collect and analyse information about the realization and development of those holding a degree in the professional field (major of regulated professions);
- conduct surveys with employers about their satisfaction with preparation of graduate students;
- conduct surveys with students before, during and after distance learning, to evaluate the level of technological preparation, the way distance learning is conducted and the access to virtual resources and activities.

[4] Higher Education Law, available at http://www.neaa.government.bg/assets/cms/-File/normativni%20doc/ZAKON_za_visseto_obrazovanie_Aug_2011.pdf, (accessed 1 May 2016).
[5] Criteria for evaluation of distance learning, available at http://www.neaa. government.bg/images/OA-IA-DFO/Kriterii-DFO.pdf (accessed 1 May 2016).
[6] Criteria System for Programme accreditation of professional fields and majors from the regulated professions, available at http://www.neaa.government.bg/images/OA-PA- PN/Kriterialna-sistema-PA-PN-Dec-2011.pdf (accessed 1 May 2016)

Therefore, conducting surveys with students is an integral part of internal university systems for evaluating and improving quality. The process of conducting these surveys implies a number of problems. Traditional survey methods require printing large number of questionnaires, special organization for completing questionnaires by the students, subsequent manual processing, analysing and interpreting a huge amount of data, which is time-consuming and could lead to technical errors. On the other hand, students don't participate willingly in surveys conducted in this way. They often give back blank questionnaires to the people who conduct the survey, or refuse to participate together. That leads to the incompleteness of the collected opinions and thus reduces the quality and reliability of the results of their analysis.

The paper proposes a solution for overcoming these problems, which is related to the automation of the process of conducting surveys and summarizing the gathered data using mobile technologies. There are two important reasons in support of the proposed solution. On the one hand, students use their mobile devices with enthusiasm. For them, smartphones and tablets are natural tools for communication, access to the Internet, mobile banking, payments and more. Now nearly every student has a smartphone with the newest technology. The idea of "tablet for every student" is just a wish in Bulgaria, but it is a fact in many other countries. For example, in the framework of the Mohammed Bin Rashid Smart Learning Program[7] in the United Arab Emirates, which includes 208 schools with over 5 000 tutors, a tablet was purchased for each student. On the other hand, the level of development of modern mobile technologies already allows mobile devices to be used to supplement or even completely replace traditional surveys conducted within internal university systems for quality assurance.

The overview of existing software tools for conducting mobile surveys showed that the number of developed mobile applications for online surveys is increasing (eg. Toluna[8], Swagbucks[9], iPoll[10], MySurvey[11],

[7] Mohammed Bin Rashid Smart Learning Program, http://smartlearning.gov.ae/, (accessed 1 May 2016).
[8] Toluna, http://www.elitesurveysites.com/recommends/toluna, (accessed 1 May 2016).
[9] Swagbucks, http://www.elitesurveysites.com/recommends/swagbucks, (accessed 1 May 2016).
[10] iPoll, https://play.google.com/store/apps/details?id=com.usamp.mobile&hl=en_GB, (accessed 1 May 2016). [VIII]
[11] MySurvey, https://www.mysurvey.com/, (accessed 1 May 2016).

SurveysOnTheGo[12], Survey.com Mobile[13], but without exception, they are commercial and are designed for the needs of business analysis. The main purpose of this type of mobile applications is carrying out of the market and business surveys like Survey Software Reviews[14], so they largely don't satisfy the needs of surveys regarding the quality of education in higher education and university quality systems.

The paper presents the developed mobile application, which allows conduction surveys for the needs of internal quality systems. It provides complete anonymity of respondents and a possibility for asynchronous completion and submission of surveys, regardless of where they are filled in and the availability of Internet connection for the mobile device. The data for each specific survey are stored in a database, which allows the automated processing of the collected opinions. The application ensures tools for authorized group of users (e.g. members of university quality committees) to generate reports with summary results from conducted surveys in the form of tables and diagrams in order to analyze and possibly make decisions towards improving the quality of learning and teaching. The paper describes probated experiments of the mobile application to conduct surveys regarding students' satisfaction with the quality of learning courses and the means used for assessment of their knowledge.

2. Mobile application for surveys

The mobile application for conducting surveys M-Survey is probably the first of its kind in Bulgaria. It is designed and developed in order to provide the opportunity for carrying out surveys among students within the internal university system for evaluating and improving of the quality of university education. The application ensures complete anonymity of the respondent because anyone can fill in questionnaires at any place and at any time. The mobile application provides possibilities for completing two kinds of questionnaires – standard built-in questionnaires and imported questionnaires. The content of each questionnaire is described in an XML format. After completion of the questionnaire by the student, the application generates a file that can be uploaded to a

[12] SurveysOnTheGo, https://itunes.apple.com/us/app/surveys -on-the-go/id443052658?mt=8, (accessed 1 May 2016).
[13] Survey.com Mobile, https://play.google.com/store/apps/details?id=com.survey.android&hl=en, (accessed 1 May 2016).
[14] Survey Software Reviews, http://survey-software-review.toptenreviews.com/, (accessed 1 May 2016).

specially designed remote server, which fully guarantees the student anonymity.

2.1. Functional and nonfunctional requirements

The mobile application must meet the following basic functional requirements to be able to be used within internal university systems of quality assurance for carrying out surveys and automated analysis of the results of the survey:

- the mobile application should provide information services for conducting of survey with multiple users;
- the mobile application should allow free access;
- the mobile application should provide anonymity of users (students who filling out the questionnaires) in a full degree;
- the mobile application should have a set of built-in questionnaires and ensure possibility for modelling of new questionnaires and importing of created within other software systems questionnaires;
- the mobile application should support open data formats;
- the mobile application has to be developed as a "native" application and support devices with different screen size and processor architecture (e.g. x86, x64 and ARM);
- the mobile application should allow work offline;
- the mobile application should allow the submission of comments, recommendations and feedback to the developer for the purpose of improvement and future development of the mobile application;
- the mobile application should ensure the compatibility for work from different mobile devices (e.g. smartphones, tablets, netbooks, etc.);
- the mobile application should provide an opportunity for an authorized group of users to analyse the survey results.

Mobile applications provide certain services to their customers using a variety of mobile devices. The individual components constituting a mobile application can be divided into several levels to facilitate the design and development of the application, following certain design and development patterns. The dividing of individual components of level enables different developers to write a code, which can be integrated with other separately written modules. Thus the application can be built module by module, and these separate modules can easily be designed, created and tested.

The architecture of the mobile application must be based on a modular basis and each module must implement different information activities in order to allow the possibility for easy integration of various functional modules. In order to provide an opportunity for further improvement of

the application, the decision must be open for development and modification.

2.2. Development

The development of mobile applications for education services is a complex and comprehensive process. It involves activities from studying the university information environment to the needs of specific applications, design, development, testing of devices with different parameters to the promotion and dissemination among students. Although these activities are similar in development of applications for desktop systems, they have their peculiarities, such as the numerous personal data processed, security and the multitude of technologies and development tools.

The more the number of mobile devices used by students and teachers grows, the more often a question arises about what approach developers choose to provide specific educational information service (e.g. training schedule, reports, notifications, messages, surveys, etc.) on mobile devices. There are two alternatives – development of a web application, which students and teachers can use through a web browser or development of a "native" application. Native applications are software applications which can be installed and operate on the mobile device and can be managed through the user interface. They are developed specifically for one platform and can take full advantage of all hardware components of the device - they can use the camera, GPS, accelerometer, compass, contact list, etc. Another feature of the native application is the ability to use embedded systems to notify the device and work offline. For security reasons, most often they are installed in app stores, e.g. Windows App[15].

The appropriate choice has to be determined by the goals. If the main goals are the application to provide a friendly user interface, high-speed operations, multimedia, offline mode, interaction with other applications on the mobile device, etc., the choice should fall on the native application (Rodrigues, Joel J. P. C. et al., 2010). On the other hand, if the application requires making frequent changes to the interface and content, if affordable cost and shorter development time are the main priorities, and if the application requires support for multiple mobile platforms, less storage space and easy updating, then the mobile web application is the appropriated choose.

[15] Windows App, https://www.microsoft.com/en-us/store/apps/windows, (accessed 12 May 2016).

In the case at hand, the selected approach is for the development of a native application. That is because, along with the already mentioned characteristics, the aim is to allow easy future development as a Personal Mobile Assistant, which would both provide students with the greatest possible range of services, and use the services of built-in assistants for mobile platforms (Gupta, B. et al., 2016) such as Cortana to Microsoft. Thus, by using the services of built-in assistant the mobile application will provide services such as search, note-taking, events management, alarms, reminders, emails sending and etc. The mobile application is implemented for Universal Windows Platform, which allows it to be installed and used on any device that uses the operating system Windows. The application can be installed on a smartphone, tablet or other mobile device or computer.

In the current development, offline mode is one of the important factors that determine the choice of a native approach instead of creation of a web application. Namely the use of this approach in the process of development of the mobile application ensures successful conducting of surveys and provides an opportunity the survey to be done without risk of interruption of Internet connectivity, which is possible on mobile devices using mobile data from the telecom operator. This provides a relaxing atmosphere for conducting the survey, without the student worrying about time or expiring web session at any time and any place.

The M-Survey is based on .NET Native technology for creation and installation of Windows applications. The technology allows applications written in C # or Visual Basic to be compiled directly to a Windows 10 "native" code. Applications that use .NET Framework usually are compiled to code of the so-called Intermediate Language, which subsequently at runtime is compiled to a "native" code by a just-in-time (JIT) compiler. The main advantage of using this technology is the great speed in execution, which is essential in mobile devices with less memory and slower processors.

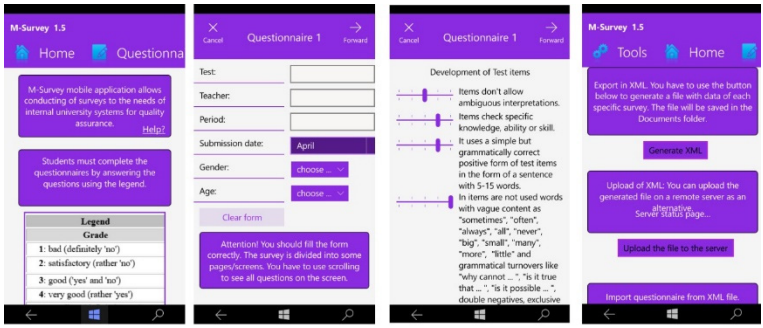


Fig. 1. Screen from the mobile application M-Survey

The M-Survey is composed of two modules. The first module provides functionality for completing the questionnaires by the user in a convenient way. For this purpose, an interface suitable for the use of mobile controls is realized. The interface of the application is simplified for the convenience of the user and it is classical with navigation at the top of the screen and built-in UI controls for easy control with gestures. Thus, the users can carry out easy access to all elements of the questionnaire (see Figure 1). The respondent students have to put assessments of the assessed characteristics of the object of evaluation according to relevant legend by using the slider, which in practice allows them to fill in the questionnaire very quickly. The module allows students to send emails with comments, recommendations and questions to the developers of the M-Survey directly from the mobile application. The feedback allows for the detection of weaknesses in the application and possibilities for improvement of the quality of application services. The Figure 1 presents a view from the corresponding survey in the mobile application M-Survey, which is conducting in the Plovdiv University "Paisii Hilendarski".

The second module provides functionality for importing questionnaires in a certain template in an XML format (see Listings 1) and exporting the completed questionnaires also in an XML format (see Listings 2). The template for importing allows the setting of minimum and maximum assessment of questions to be put to students, which allows the user to define different rating scales for each questionnaire separately. The module also provides possibilities for uploading the generated file on a remote server specifically designed for the needs of M-Survey application.

<?xml version="1.0" encoding="UTF-8"?> <Card> <CardNo> 45 </CardNo>	<?xml version="1.0" encoding="UTF-8"?> <Questionnaire> <Card>

```
  <MinMark> 1 </MinMark>
  <MaxMark> 5 </MaxMark>
  <Questions>
   <Question> Items don't allow
   ambiguous interpretations.
   </Question>
   <Question> Items check specific
knowledge, ability or skill.
</Question>
   <Question> It uses a simple but
grammatically correct positive form of
test items in the form of a sentence
with 5-
15 words. </Question>
    …
   </Questions>
</Card>
```

```
   <CardNo> 1 </CardNo>
   <QuestName> Operating systems
   </QuestName>
   <TeacherName> Nikolay Kasakliev
   </TeacherName>
   <QuestPeriod> 10 - 20 april
   </QuestPeriod>
   <QuestDate> 22.4.2016
   </QuestDate>
   <Gender> Female </Gender>
   <Age> 35-44 </Age>
   <Answers>
    <Question 1> 5 </Question 1>
    <Question 2> 4 </Question 2>
    <Question 3> 4 </Question 3>
    <Question 4> 3 </Question 4>
    …
   </Answers>
  </Card>
</Questionnaire>
```

Listing 1. XML (Questionnaire for import) Listing 2. XML (Completed questionnaire)

The application uses a SQLite database for storing the data, which allows offline mode. The SQLite relational database is an open source, fully compatible with standard SQL database. Its main characteristic is that the whole database is collected in a single file. Another distinctive feature is that it is one of the few databases without the need for installation and fro acting as a server process, which make it particularly suitable for use in mobile devices.

In order to ensure anonymity, the mobile application was designed and created so that it does not store or process any data that could identify a respondent student, including data for a particular device (hardware, software, etc.), location, mobile operator or others.

The users of a mobile application are the people who will benefit from its functional possibilities through specific interface of the particular device. They can use the allowed commands and thus obtain the necessary information, as well as process the data. Because the mobile application is designed for mobile devices (mobile platforms currently support almost exclusively single user mode), and because the core functionality of the application requires anonymity in completing the questionnaire, it does not support working with different categories of users. However, we should clarify that one device can examine the views of many students, and to generate a single file with summary result of completed questionnaires. So the development, along with personal work, permits carrying out of surveys with many students on one device (e.g. tablet in formal or informal environment - classrooms, laboratories or open spaces within the university campus).

3. Automated analysis of results

An additional module, M-Analyses, for analysing results in real time for a particular group of users is developed on the basis of stored data from conducted surveys. That is to ensure the possibility for automated analysis of the results from conducted surveys, as well as monitoring of ongoing surveys within the framework of the university system for quality assurance. The module allows members of university quality committees to generate reports about analysing results from conducted surveys and data on current progress in surveys conducted in a real time. The module provides "easy to use" features and graphical user interface for entering the parameter values needed for the generation of reports. The module serves as a visualization tool when it comes to presenting the results of the evaluation.

The additional module M-Analyses is developed on the basis of Jaspersoft Business Intelligence Solutions[16]. The module uses its capabilities for creating reports and analyses by retrieving data from different data sources for storing, for the organization of reports in a repository and for presenting them in the preferred by the user form. The architecture of Jaspersoft is a modular, scalable, based on standards and it provides the flexibility needed to easily development of the module for analyzing surveys results. The architecture of the module includes two of JasperSoft's

tools - JasperSoft Studio and JasperReport Server. Jaspersoft Studio is an eclipse-based report designer for JasperReports Server. It allows the creation of very sophisticated layouts containing

charts, images, subreports, crosstabs and much more, access to data through different data sources (including custom sources) and publication of reports created in various document formats. JasperReports Server is a stand-alone and embeddable reporting server optimized to share, secure and manage templates of analytical reports created in JasperSoft. It provides reporting and analytics that can be embedded into a web or mobile application as well as operate as a central information hub for the enterprise by delivering mission-critical information on a real-time or scheduled basis to the browser, mobile device, printer, or email inbox in a variety of file formats. JasperReports Server' web services allow client applications to interact with the server.

[16] Business Intelligence Solutions, http://www.jaspersoft.com/business -intelligence-solutions (accessed 1 May 2016)

The module is developed into 4 (four) steps (Gaftandzhieva, S. 2016; Doneva, R. and Gaftandzhieva, S. 2015).

- Step 1. Integration between Jaspersoft Studio and the mobile application M-Survey, which is set as a data source for retrieving data and creating reports for monitoring of ongoing surveys and analysing the results from conducted surveys;
- Step 2. Development of templates of analytical reports in JasperSoft Studio, which can be later used to generate real reports containing summarized data related to conducted surveys;
- Step 3. Compilation of templates of analytical reports (developed in Step 2) in a specific internal format and storage of the templates in the JasperReports Server repository;
- Step 4. Integration of the JasperReports Server with the developed module through shared web services.

The primary objective of the module for automated analysis of the results from the conducted surveys and monitoring of students' activity in ongoing surveys is to allow monitoring of surveys for each learning course, specialty, professional field and field of study. To achieve this objective, for each specific questionnaire, relevant templates of analytical reports (see Column 1 of Table 1) are designed in Step 2 of the development process of the module, according to specific parameters (e.g. learning course, course, specialty, professional field, field of study, see Column 2 of Table 1). They allow the retrieval of evaluation data for monitoring students' activity in ongoing surveys and for generating evaluation reports that contain summarized information about conducted surveys (see Column 3 of Table 1) and thus allowing decision making in for quality improvement.

Template	Parameter	Returned information
Number of courses in which conduction of the survey is planned	Professional field	• Specialty • Number of leaning courses • Total number of learning courses from all specialty in the professional field
A list of courses in which conduction of the survey is planned	Professional field	• Specialty • Learning course • Total number of specialties and courses in which the survey will be conducted
Number of courses in which the survey is already conducted (by Professional field)	Professional field	• Specialty • Number of courses • Total number of specialties and courses in which the survey is conducted

A list of coursers in which the survey is conducted	Specialty	• Learning course • Number of courses in which the survey is conducted
A list of coursers in which the survey is conducted and the corresponding number of respondents	Specialty	• Learning course • Number of completed questionnaires • Total number of courses and completed questionnaires
Summarized results from the survey by professional fields		• Professional field • Received assessment
Summarized results from the survey by fields of study		• Field of study • Received assessment
Summarized results of the survey by the evaluated characteristics of course	Professional field	• Question (evaluated characteristic) • Percent of students that answered 1 • Percent of students that answered 2 • Percent of students that answered 3 • Percent of students that answered 4 • Percent of students that answered 5

Table 1. *A set of templates and parameters for questionnaire "Students' satisfaction from the quality of courses"*

Jaspersoft creates a source code in an XML format for each designed template. The developed templates are compiled in a special internal format and are stored in the Jaspersoft repository, which is realized in Step 3. In this way they can be used both by the level of the very same UBIS- Jaspersoft system and by another external application for the generation of the relevant reports that are filled with data from the given data source.

Users of the M-Analysis module are members of university quality committees. They can use the M-Survey module to generate dynamic evaluations in the form of reports by selecting from the proposed capabilities (dynamically generated list of available templates of analytical reports) anytime they want to monitor the activity of students in ongoing surveys and to analyse the results from conducted surveys. The monitoring of student activity and analyses of the results can be obtained by specialty, professional field or field of study.

Besides selecting the type of report that will be generated in a real-time, the user must set values for necessary local parameters of the report (see Figure 3). The alternatives parameters and their values, among the user can choose, are retrieving from the data source. This limits user choice and thus eliminates the possibility of introducing incorrect data.

The generated report contains data (in the forms of tables and charts) that the user can use from the user to evaluate to what extent students

have participated in surveys and analyse results from conducted surveys. The generated report can be displayed on the screen and the user has the possibility to download it in PDF format.

All templates of reports are programmed to create reports for pre-selected parameters, and to store those reports in a repository of UBIS-JasperSoft in PDF format. The purpose of this is to allow for automated, dynamic generation of summarized reports of ongoing surveys at pre-selected dates. Those reports can be used as supporting documents in the preparation of self- evaluation reports for accreditation of distance learning in the professional field or program accreditation of professional fields and majors from the regulated professions.

4. Experiments

The developed mobile application is experimented in the University of Plovdiv through carrying out surveys related to students' satisfaction with the quality of their courses and with the means used to assess their knowledge (tests for assessing knowledge).

4.1. Students' satisfaction with the quality of courses

The primary source of information for evaluating students' satisfaction is the survey for evaluation of course quality (Totkov, G. et al. 2014). The proposed survey is created on the basis of the NEAA criteria system for evaluating distance learning. It contains around 50 questions with answers 1 - bad (definitely 'no'), 2 - satisfactory (rather 'no'), 3 - good ('yes' and 'no'), 4 - very good (rather 'yes') and 5 - excellent (definitely 'yes') in 4 areas:

- course documentation and learning goals;
- team for distance learning provision;
- infrastructure for distance learning;
- preparation and conduct of distance learning.

A total of 101 students from specialties in 4 professional fields took a part in the experimental survey. They assessed the quality of 10 training courses, probated within the project PeU – a national standard for conducting high-quality e-learning in higher education (Totkov, G. and Doneva, R. 2014). Members of university quality committees had a possibility to monitor ongoing surveys and generate reports on the proposed templates to obtain a summary of completed questionnaires for:

- number of courses, in which the conducting of the survey is planned (with added questionnaires) by each professional field offered in the university training;

- number of courses, in which the conducting of the survey is planned (with added questionnaires) by each field of study offered in the university training;
- number of courses, in which the conducting of the survey is planned (with added questionnaires) by each specialty offered in the university training;
- a list of courses by the corresponding professional fields, in which the conduction of the survey is planned;
- a list of courses by the corresponding specialties, in which the conduction of the survey is planned;
- number of courses by professional fields, in which the survey is already conducted (with completed questionnaires);
- a list of courses by specialties, in which the survey is already conducted (with completed questionnaires);
- a list of courses by specialties, in which the survey is already conducted along with the corresponding number of participants in the survey (number of completed questionnaires);
- a list of courses by professional fields, in which the survey is already conducted along with the corresponding number of participants in the survey (number of completed questionnaires);
- summarised results of the survey by professional fields (see Figure 2);
- summarised results of the survey by field of study;
- summarised results of the survey by evaluated characteristics of learning course.

The Figure 2 presents an example of the generated report that gives a summary evaluation information about students' satisfaction with the quality of courses by each professional field offered in the university training.

University of Plovdiv
"Paisii Hilendarski"

Summarised results of the survey by professional fields

Professional field	Average result
1.2. Pedagogy	4.16
1.3. Pedagogy of learning	4.69
4.6. Informatics and Computer Sciences	4.34
5.3. Communication and Computer Techniques	4.37

This report has been generated on 09.05.2016 at 11:02:47 PM

Fig. 2. *Example of generated report for learning course quality evaluation*

4.2. Students' satisfaction with the quality of means used for assessment of their knowledge

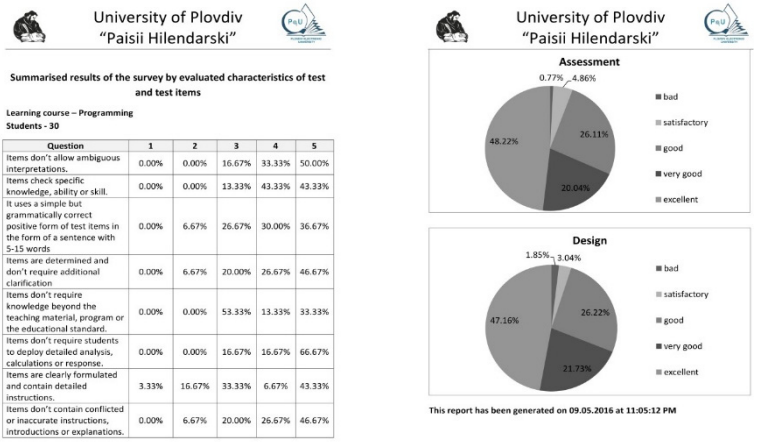
The second experiment provides the possibility for feedback about the quality of tools used for assessing students' knowledge. The quality evaluation of these means used assessing of knowledge (and the included test items) allows teachers to make changes in tests in order to improve their reliability.

The primary source of information for evaluating students' satisfaction with the quality of means for assessment of their knowledge is the survey for evaluation of tests and test items (Gaftandzhieva, S. et al., 2016). The survey contains around 39 questions for quality of tests and test items with answers 1 - bad (definitely 'no'), 2 - satisfactory (rather 'no'), 3 - good ('yes' and 'no'), 4 - very good (rather 'yes') and 5 - excellent (definitely 'yes'). The questions are divided into 5 areas - Development of test items, Test Creation, Test conducting, Assessment and Design.

Members of university quality committees had the possibility to monitor ongoing surveys and generate reports on the corresponding proposed templates on the basis of completed questionnaires for quality evaluation of tests and test items, with the aim to obtain a summary of:

- A list of courses by corresponding specialties, in which the conducting of the survey is planned;

- Number of courses, in which the survey is already conducted by professional fields;
- A list of courses by specialties, in which the survey is already conducted along with the number of completed questionnaires;
- Number of courses, in which the survey is already conducted by professional fields;
- A list of courses, in which the survey is already conducted along with the number of completed questionnaires for each course;
- Summarised results of the survey by specialties;
- Summarised results of the survey by professional fields;
- Summarised results of the survey by field of study;
- Summarised results of the survey by evaluated characteristics of test and test items (see Figure 3).
- The Figure 3 presents an example of the generated report (first and last pages) with summarized result of the survey conducted within the experiment on evaluated characteristics of means for assessment students' knowledge, used in the course "Programming" on the basis of completed questionnaires from 30 students.



University of Plovdiv "Paisii Hilendarski"

Summarised results of the survey by evaluated characteristics of test and test items

Learning course – Programming
Students - 30

Question	1	2	3	4	5
Items don't allow ambiguous interpretations.	0.00%	0.00%	16.67%	33.33%	50.00%
Items check specific knowledge, ability or skill.	0.00%	0.00%	13.33%	43.33%	43.33%
It uses a simple but grammatically correct positive form of test items in the form of a sentence with 5-15 words	0.00%	6.67%	26.67%	30.00%	36.67%
Items are determined and don't require additional clarification	0.00%	6.67%	20.00%	26.67%	46.67%
Items don't require knowledge beyond the teaching material, program or the educational standard.	0.00%	0.00%	53.33%	13.33%	33.33%
Items don't require students to deploy detailed analysis, calculations or response.	0.00%	0.00%	16.67%	16.67%	66.67%
Items are clearly formulated and contain detailed instructions.	3.33%	16.67%	33.33%	6.67%	43.33%
Items don't contain conflicted or inaccurate instructions, introductions or explanations.	0.00%	6.67%	20.00%	26.67%	46.67%

Fig. 3. Example of generated evaluation report for quality of test items and tests

5. Conclusion and future work

The developed mobile application allows the conducting of surveys within the internal university systems for quality assurance. The M-Survey app allows users to import questionnaires easily and quickly, to export data from completed questionnaires, and to fill out questionnaires in an easy and effective way with a guarantee of complete anonymity. The mobile

application is published in Microsoft's app store, which is a guarantee for security and the possibility for installation of different devices. Due to the fact that the app supports data in an XML format, the data can easily be used/imported from/in other software tools for further processing.

A software module M-Analyses, is developed for automated processing of the results of the surveys. It allows the extraction and processing of data also from other information sources - not only on the specific application, in which the survey is conducted (e.g. processing of data results from surveys conducted in the learning management system Moodle used in the University of Plovdiv).

The functionality of the mobile app will be expanded to execution and automated analyses of results from other surveys that are part of the internal university system for quality assurance. This suggests expanding the functionality by adding the possibility of modelling a questionnaire and developing a corresponding set of templates for analysing survey results for each modelled questionnaire.

Research funding

The paper is partly supported within the project MU15-FFIT-001 "A methodology for creation and dynamic updating of test items and tests with automated evaluation of their quality" of the Scientific Research Fund at Plovdiv University "Paisii Hilendarski".

References

[1] Doneva, R. and Gaftandzhieva, S. (2015), Automated e-learning quality evaluation, e-Learning'15 Proceedings of the International Conference on e-Learning, 11-12 September 2015, Berlin, Germany, ISSN 2376-6698, pp. 156-162.

[2] Gaftandzhieva, S. (2016), Automated Evaluation of Students' Satisfaction, International Journal of Information Technologies and Security (IJITS), Issue 1 (vol. 8), pp. 31-40.

[3] Gaftandzhieva, S. et al. (2016), Automatised Evaluation of Test Quality in e-Leaning, in Proceedings of 6-th National Conference on E-Learning in Higher Education Institutions, 2016, Bulgaria.

[4] Gupta, R. et al. (2016), Using affective brain-computer interfaces to characterize human influential factors for speech quality-of-experience perception modelling, Human-centric Computing and Information Sciences 6:5, DOI: 10.1186/s13673-016-0062-5.

[5] Rodrigues, Joel J. P. C. et al. (2010), New Trends on Ubiquitous Mobile Multimedia Applications, EURASIP Journal on Wireless Communications and Networking, DOI: 10.1155/2010/689517

[6] Totkov, G., Doneva, R. (2014), Plovdiv electronic university – A national standard for conducting of high quality e-learning in higher education system, in Proceedings of 5-th National Conference on E-Learning in Higher Education Institutions, ISBN 978-954-712- 611-4, 16-17 May 2014, Ruse, Bulgaria, pp. 103-108.

[7] *Totkov, G. et al. (2014), An e-learning Methodology, ISBN 978-954-8852-43-2, Rakursi, Plovdiv, Bulgaria (in Bulgarian).*

Indicators of quality technology-enhanced teaching and learning

Boyan Jekov[1], Petya Mihaylova[2]

[1]University of Library Studies and Information Technologies, [2]Technical University of Sofia

Sofia /Bulgaria

[1]boyan.jekov@gmail.com, [2]petya.tihomirova@gmail.com

Abstract

The changing nature of work and society means that the premium in today's world is not merely on students' acquiring information, but on their ability to analyze, synthesize, and apply what they have learned to address new problems, design solutions, collaborate effectively, and communicate persuasively (see e.g., Bereiter & Scardamalia, 2013) The impact of Information Communication Technologies (ICT) on the student learning experience in Higher Education (HE) has not been evaluated on regular bases due, probably, to the lack of importance that is given to ICT integration in pedagogical strategies. The increasing demands of the different University stakeholders, however, suggest a more sustained evaluation of the impact of the use of ICT in teaching and learning. Therefore it is strongly necessary to comply with the world's requirements we lived in and all well-known teaching methods to be changed according to these requirements and to fit the evaluation methodology in dynamic transformation of information perceiving and analyzing by the new educating generation. Establishment of new indicators for quality technology-enhanced teaching and learning is crucial, considering as well the implication of Information and Communication Technologies and Internet. This rises to completely new styles of teaching, arising from imposing new styles of knowledge consumption. This article makes a literature review of existing teaching styles and indicators and factors for quality assessing of teaching and learning. In the case study we are going to examine an English Language Center in Bulgaria, where the teaching methods crushes the traditional educational frameworks. This Center educates less dependence on rote learning, repetitive tests and a 'one size fits all' type of instruction, and more on engaged learning, discovery through experiences, differentiated teaching, the learning of life-long skills, and the building of character, so that students can develop the attributes, mindsets, character and values for future success.

Keywords:

1. Introduction

In the age of Internet and rapidly developing communication technologies, information is all around us. Knowledge acquiring is no more a process of information gathering and assimilation, but more soft skills elaboration, accustom love of science and knowledge. Traditional education methods are easily predictable and learners feel comfortable in this shape, thus they have needed preparation to break through the system. The challenge here is to catch and keep their attention so long they can percept needed knowledge and abilities. Modern youth prefer to watch, read and talk instead of writhing. They need of abundant general knowledge to formulate their own opinion. Critical and creative thinking formulate opinion based on minimum abundant general knowledge. This rises to completely new styles of teaching, arising from imposing new styles of knowledge consumption. Education with less dependence on rote learning, repetitive tests and a

'one size fits all' type of instruction, and more on engaged learning, discovery through experiences, differentiated teaching, the learning of life-long skills, and the building of character, so that students can develop the attributes, mindsets, character and values for future success. This is what a technology enhanced teaching and learning can contribute.

2. Literature Review

2.1 Flexible Thinking in Learning

In the age of rapid educational and technological changes, learners are required to think flexibly and adapt to new ways of learning and communicating [1] Flexibility is one of many skills necessary for success in work, life, and learning in the 21st century [2]. The conceptualization of flexible thinking has appeared in studies since 1960's and 1970's which considered flexibility as one of four basic function of divergent thinking. The definitions of flexible thinking are used interchangeably with term cognitive flexibility. Spiro and Jehng (1990) viewed cognitive flexibility as "the ability to spontaneously restructure one's knowledge, in many ways, in adaptive response to radically changing situational demands" [3]. Garner defined in 2009 in psychology studies flexible thinking as a higher order thinking skill and an aspect of executive functions. It concerns instantaneous consideration of multiple perspectives and the ability to make changes in one's thoughts or beliefs. Teaching of 21st Century Skills project, addressed flexibility as part of the 'ways of thinking' domain, indicating the need for educating people to become "open and fair

minded, flexible in considering alternative opinions" (Griffin, McGaw, & Care, 2012, p.40). In a social perspective, flexible thinking is conceptualized as the ability of an individual in a group to collectively assess her/his own behavior, and make the

required adjustments for effective functioning [4]. The Organization for Economic Cooperation and Development (OECD, 2009) viewed flexibility and adaptability as examples of essential competencies in the context of collaboration and teamwork. Similarly, the Partnership for 21st Century Skills [5] conceptualizes flexibility as willingness to make necessary compromises in order to accomplish a group's common goal.

There are 3 basic factors that may indicate a learners' dispositional inclination to think flexibly in technology-enhanced learning.

- *Technology acceptance* -ICTs development together with the mobile devices has changed the way teaching and learning are conceptualized and conducted. Activities or environments that are mediated, supported, facilitated, or augmented by web-based technologies and mobile devices. As ICTs continue to develop, new learning methods evolve, requiring learners to be flexible in their ability to use them efficiently [6]. Hence, technology acceptance and adoption, in various contexts, is a main factor of contemporary flexible thinking in learning.
- *Open-mindedness* - Open-mindedness is a multifaceted construct that includes the willingness to change one's beliefs in the face of contradictory evidence. It is conceptualized as a flexible approach to alternative views and perspectives. Open- mindedness is the ability to consider new possibilities, different opinions, and alternative explanations. Openness and flexibility are thought of as two sides of the same coin - structure and process, antecedent and consequent [7]. Openness to experience is one of five personality traits mentioned in the Five Factor Model together with neuroticism, extraversion, agreeableness, and conscientiousness (McCrae & John, 1992). Individuals who think flexibly are open to new ideas and exhibit greater success in dealing with life changes, they process new information and explore new environments easily.
- *Adapting to new or changing situations* - Rapid changes in the way people communicate and construct knowledge require the ability to adapt to new situations. In contemporary education, adaptability is thought of as an essential skill since students are required to use new learning methods, environments, and tools. One characteristic of adaptability is the willingness to be involved in an unfamiliar situation. This can be a new learning topic, a new learning environment, or a new

problem to solve. As part of flexible thinking, adaptability allows a learner to engage with these unfamiliar situations in an efficient way. It explains students' ability to transfer what they have learned to new situations, since flexible learners are prepared to challenge the unknown and face the unfamiliar. Flexible thinkers adapt easily to varied roles, responsibilities, schedules, and contexts.

2.2 Technology Enhanced learning

Expectations and perceptions are different in both learning environments. Students expect different attitudes from the teacher; probably they would not expect a more active role, but a more present one. The teacher, however, will expect from the learner a more autonomous profile, and a more independent learning path. The Quality of Technology-enhanced learning is made by five dimensional evaluations.

1. **Expectations and perceptions**: all the criteria related with the expectations and the perceptions of stakeholders when facing TEL practices and if these expectations are fulfilled.
2. **Competences**: all criteria related with the competences needed by the actors in the process of
3. teaching and learning: teaching staff and students. As referred above we considered, for the definition of competences, all characteristics, behaviours and attitudes, skills and knowledge that one actor as to possess to take part of TEL practices.
4. **Learning environment and learning resources**: all the criteria related with the quality of the learning environment designed by the practitioner, the learning resources proposed and the context they are proposed for.
5. with the strategies that both teachers and students develop when facing TEL practices.
6. 5. **Logistics and support**: all the criteria related with the logistics and equipment needed for a TEL practice, and the support given by the university in the form of tools, helpdesk and training. [8] Based on these 5 dimensions a Framework of Reference was created with 28 criteria related to the technology enhanced learning. In Fig. 1 are presented all 28 criteria.

Tin our case study we are going to look through a Bulgaria language school and its ideology for educating young people. Creative Language school Evona is a school which basic goal is not only to teach a foreign language to its students, but to acquire soft skills such as – emotional intelligence, empathy, sensible team work. The Soft Skills are crucial for personal intelligence and future successes. The driving idea is to educate creativity,

presentation skills and public speaking. Traditional teaching methods are heavy and keeping pupils attention is very difficult almost impossible issue. That is why Evona decides to keep the students attention as make them a part of the process. Teachers and students together define the rules. Even it is allowed to the students to set their own rules. The only one unbreakable rule is that: All set rules need to be strictly followed. Learners in Evona are grouped by their age – Starting with pre-scholars, till higher education students.

The teaching methodology and approach in the different group ages is completely consistent with their needs, speed and attitude of perception.

Criteria	Criteria descriptors
Dimension: expectations and perceptions	
Enhancement of academic success	Academic success is explicitly expressed and is directly linked to the use of TEL
Clarification of roles	Teacher and students know in advanced what is expected from them and what "the rules of the game" are
Enhancement of motivation	Teacher and students are more willing to pursue with their roles
Enhancement of participation	Students participate more in the teaching and learning process
Enhancement of satisfaction	Teacher and students feel more satisfied with their roles
Existence of communicational competences	There are communicative competences from both teacher and students
Existence of entrepreneurial competences	Both teacher and students embrace innovations and new trends
Existence of pedagogical competences	The teacher has pedagogical competences that allow him/her to use adequate strategies, integrate ICT and monitor each learner path
Existence of scientific competences	The teacher has scientific competences related with the taught subject
Existence of self-regulation competences	The students have self-regulation competences
Existence of technological competences	Both teacher and students have the necessary technological competences
Dimension: teaching and learning strategies	
Accuracy	TL strategies are accurate and respect the requirements involved
Diversity	TL strategies respond to the diversity of methods and student profiles
Effectiveness	TL strategies are effective and respond to their purpose fulfilling the proposed Learning Outcomes
Respect for ethics	Ethical principles are always respected
Inclusion of a constructivism approach	TL strategies used foster active learning and enhance the learning process
Strategies suitability	TL strategies are adequate for an online learning environment
Dimension: learning environment and resources	
Accessibility	The learning environment is always accessible and respects norms
Dimension: logistic and Support	
Adequacy of administrative resources	Online administrative resources are present and fulfill the requirements
Adequacy of human resources	There is human support when needed, such as tutors or instructional designers
Institutional recognition	The institution values the teacher and students work
Adequacy of pedagogical support	There is pedagogical support for teachers and students, such as training
Institutional regulation	Institutions evaluate the impact and the quality of the course
Adequacy of scientific resources	The institution gives access to the necessary scientific resources
Adequacy of technical resources	The institution gives access to the necessary tools and equipment
Adequacy of technical support	Technical support is always available for helping teacher and students

Fig. 1 Quality Framework for Technology Enhanced Learning

3 CaseStudy

3.1. Pre-scholars to 2nd Grade

The teaching method is craft-based. This is a method uses both art and craftsmanship. The educational topics are all around – the nature, food,

weather, etc. Their main teaching and learning instrument is the Folder. It is called the Book of Knowledge. BK keeps all the things which the children create by themselves. Using daily activities, learners are educated in a manner to be completely adequate to the quick-changing environment and circumstances.

3.2. 2nd -4th Grade

In this grout the teaching method is video-based. Pupils watch short documentary or serial film, very often proposed by their own and after that, have discussion on it, or perform some specific artistic tasks based on the video. And here they keep all they know in the Book of Knowledge.

3.3. 4th Grade and Up

The approach in this groups aims to design and develop their creativity. Good leaders and successful people are the creative ones. All the classes are based on this ideology. In these groups the main learning instrument is no more the BK, but technology. It is technology-based language education. While the learners study foreign language, simultaneously they acquire knowledge and skill of new technologies. For instance, how to use Google drive, how to make a powerpoint presentation, how to put subtitles on a video in youtube etc.

All the groups in age bigger than 4th grade use educational platform Schoology.com and vocabulary application Quizlet. Following all the requirements in Foreign Language Teaching process, learners study it by enjoying themselves.

3.4. Schoology

Educational platform is divided by Groups and Courses. Each group or course has its own wall – Updates - similar to Facebook. It allows posting links, files, resources even real time quest which gives immediate feedback. The Updates availability inspire the learners to write in foreign language and to practice it easy and funny.

Lack of emojy is other advantage, because like this the students learn to express their emotions, and opinion practicing the language.

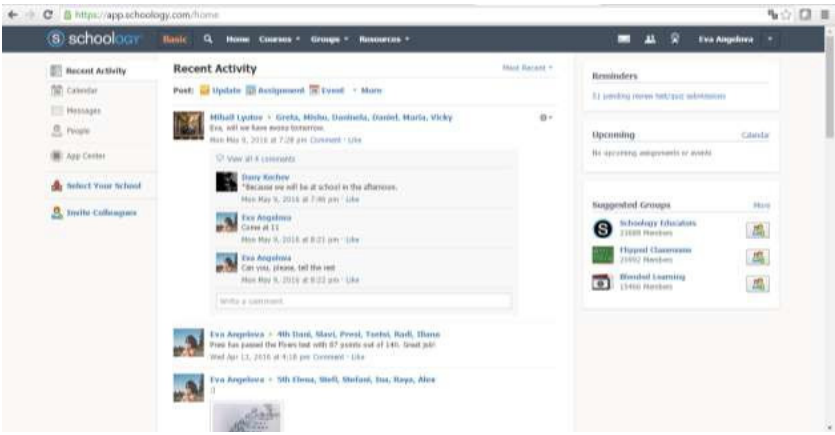


Fig. 2 Schoology main interface

3.5. Quizlet

Quizlet is an application which use pictures and listening for easy study and remind of vocabulary. Using Quizet learners study 2 times more word per class and remind them for 4 times less time. For instance in a 80 minute class before using Quizlet the vocabulary were consist of 40 words. Now in 80 min class learners takes 80 new vocabularies. Reminding the vocabularies from the previous classes takes 40 minutes without Quizlet and 10 minutes with Quizlet.

Fig. 3 Quizlet – vocabulary learning application

This application allows different study moods: Scatter; Learn, Test, Flashcards, Space Race and Speller.

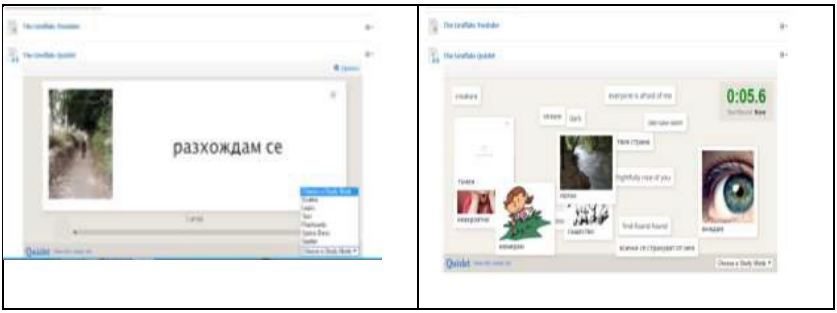


Fig. 4 Quizlet different study moods

A typical class in Creative Language School Evona proceeds in the following steps:

1. Reminding the vocabulary with Quizlet
2. Watching movie or video
3. Discussion based on the movie
4. Creative writing – there are 2 pictures and a stories should be create based on them
5. To write Bulgarian subtitle of a video in Youtube, to put them on the video and play it again in Youtube.
6. Webquest – self-sufficient work. A task is delegated with described all necessary steps which should be taken and all resources attached.

Using of an Education platform and vocabulary application, make learners more independent, self-conditioned, giving and receiving immediate feedback.

4. Conclusion

Presented in the article Frameworks and indicators focus attention to a new style of evaluation completely differentiated of traditional ones. New teaching methods and approaches are creativity development based. The teaching should be accepted as a constantly process through whole human life and learning to be considered as a love to knowledge. These two main perceptions are leading in indicators' formation as presented in this article. The teaching methodology in the examined case study fully respond to presented indicators. Flexible thinking formation is a base of learning of life-long skills, and the building of character, so that students can develop the attributes, mindsets, character and values for future success.

References

[1] Griffin, P., McGaw, B., & Care, E. (Eds.) (2012). Assessment and Teaching of 21st Century Skills. Dordrecht: Springer. DOI: 10.1007/978-94-007-2324-5

[2] Organization for Economic Cooperation and Development (OECD) (2009). 21st century skills and competences for new millennium learners in OECD countries, OEC Educatio Working Papers 41, Paris: OECD Publishing. DOI: 10.1787/218525261154

[3] Barak M. & Levenberg A. (2016), Flexible Thinking in Learning: An Individual Differences Measure for Learning in Technology-Enhanced Environments, Computers & Education doi: 10.1016/j.compedu.2016.04.003.

[4] McComb, S. A., Green, S. G., & Dale Compton, W. (2007). Team flexibility's relationship to staffing and performance in complex projects: An empirical analysis. Journal of Engineering and Technology Management, 24(4), 293-313. DOI:10.1016/j.jengtecman.2007.09.004[5] Partnership for 21st Century Skills (P21) (2009). P21Framework Definitions. Retrieved July 13, 2015 from: http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf

[6] Barak, M. (2014). Closing the gap between attitudes and perceptions about ICTenhanced learning among pre-service STEM teachers. Journal of Science Education and Technology, 23(1), 1-14. DOI: 10.1007/s10956-013-9446-8

[7] Spiro, R. J., Collins, B. P., & Ramchandran, A. R. (2007). Modes of openness and flexibility in cognitive flexibility hypertext learning environments. In B. Khan (Ed.), Flexible Learning in an Information Society (pp. 18-25). Hershey, PA:Information Science Publishing. DOI:10.4018/978-1-59904-325-8.ch002

[8] Diogo Casanova, António Moreira & Nilza Costa (2011). Technology Enhanced Learning in Higher Education: results from the design of a quality evaluation framework (pp.6). International Conference on Education and Educational Psychology (ICEEPSY 2011)*

Technology Enhanced Teaching in Bulgarian Schools - Teachers' View

Valentina Terzieva[1], Petia Kademova-Katzarova[2],
Katia Todorova[3], Rumen Andreev[4]

Institute of Information and Communication Technologies
Bulgarian Academy of Science
Sofia /Bulgaria

[1]*valia@isdip.bas.bg,* [2]*petia@isdip.bas.bg,* [3]*katia@isdip.bas.bg,*
[4]*rumen@isdip.bas.bg*

Abstract

The paper investigates Bulgarian teachers' attitude to ICT-supported teaching. The purpose is to locate the place of e-learning resources in the teaching process, their interactions and combination with traditional education. The applied research approaches are literature review and quantitative methods. The data were collected through an anonymous questionnaire. The survey is spread among teachers both online and in traditional manner. The paper summarises teachers' viewpoints regarding their role and challenges in practicing ICT based-teaching and the influence on students at school. The respondents report also how diverse teaching-learning activities take advantage of new technologies. The originality of the investigation is in the subject of questions. They concern the sub-goals in the following aspects: teaching methodology (where and how often it is appropriate to apply ICT resources in the teaching), psychological aspect (impact on learners), challenges (institutional support and obstacles) for the implementation of new technologies. The value of survey is finding out the actual level of usage of ICT learning resources in Bulgarian schools. Some aspects of the gained results are compared with those in related works; we explore and analyse how the technology-based approaches matches with the teaching at different school levels.

Keywords:

ICT, learning resources, teachers' attitude, technology-enhanced learning

1. Introduction

Nowadays ICT are used almost everywhere in human life and education is not an exception. Usually young people of the "digital generation" (Prensky, M. 2008) use technology devices in almost all their activities, so they expect to receive their "daily dose of technology" at school too. Most of the researchers point out the crucial role of technological skills for advances in all areas – economics, education, career, etc. So recently, ICT-based tools have been widely used in schools for educational purposes. Thus teachers and students receive a powerful support in teaching and

learning. Technology enables more engaging teaching approaches than traditional and this can be the factor for a more effective educational process. Technology-based learning resources have the potential to change learning environment, knowledge delivery and teaching practice as a whole. ICT influences the educational process in three ways: study of ICT (acquisition of digital literacy and their potential application); teaching through ICT tools (usage of "smart" devices in class); learning through ICT resources (radical change of the educational paradigm – traditional into e-teaching/ e-learning) (http://ncca.ie/uploadedfiles/ECPE/ICTEnglish.pdf , May 2016). The paper presents a summary of teachers' viewpoints regarding their role and challenges in practicing technology-enhanced teaching, as well as the influence on students at schools. The purpose is to locate the place of ICT-based learning resources in the teaching–learning process, as well as their interactions and combination with traditional form of education. The section 2 of the paper gives an analysis of related works. The section 3 describes the methodology of performed investigation. In part 4 the obtained results of the survey and its analysis are given.

2. Related Works

Many investigations about the ICT usage in education are conducted in the last years. Some outcomes follow: in Italy ICT is integrated into cross-curricular subjects especially for languagesand basic skills in maths and literacy (Allsop, Y. 2013); the government of Turkey provides schools with the main technical equipment and ICT is a part of the curriculum at a national level, but it is not successfully integrated in schools. It is a compulsory subject only in primary schools and an elective at secondary levels; the integration of ICT in Finland is hindered by the deficient technical and pedagogical skills of teachers and so the (necessary) investments in improving teachers' skills and knowledge give good results (Atjonen, P. 2006). Hong Kong has also invested in technical infrastructure at schools and Internet connectivity. The main challenge is the lack of sufficient physical space for establishing an effective, technology-rich learning environment in school (Atjonen, P. and Li, S. C. 2006). All teachers in Hong Kong have to pass basic ICT training. The technological tools in Bulgarian schools are scarce (PISA survey 2012, http://gpseducation.oecd.org/CountryProfile?primaryCountry=BGR, accessed May 2016): one computer for every 15 fourth graders, while EU average is 7; 43 fourth graders per laptop (the EU average is 20). Even worse is the usage of interactive white boards – one board per every 1000 fourth graders (the EU average is 100). There are 125 eighth graders per internet connected laptop (EU average is 14). Although Bulgarian schools are not well provided with equipment, it is fully used. Our students take

first place in computer usage for educational purposes at school –71% at least once a week, compared to 53% in EU.

3. Methodology of survey

We apply literature-based investigation review and quantitative methods as a research approach. We chose a questionnaire as a method of data collection that is carried out anonymously online and one third in traditional manner. The survey (http://www4.iccs.bas.bg/survey, accessed Dec.2014) is focused on different types of topics such as opinions, preferences, and factual information about the application of ICT in pedagogical practice. It is created by open source online tool LimeSurvey. The quantitative methods include mathematical modelling and analysis of the results. The chosen survey instrument provides a quantitative description and visualization of gathered statistical information. The questions concern the sub-objectives covering the following aspects: teaching methodology (when, where and how it is appropriate to apply ICT in the learning process); psychological (impact on learners); challenges (institutional support and obstacles for the implementation of the new technologies in classrooms), etc. The teachers also are encouraged to share their thoughts freely in addition to the closed questions. We analyse their answers depending on several factors: learners' grade, type of teaching activities, learning subject, etc. Part of the results has been shown in (Terzieva V. et al., 2014).

The survey is conducted mostly in public schools in different sized cities, including the capital. Half of the teachers are in high secondary level, 36% in low secondary and 14% in primary level. The majority of them (56%) teach Informatics, Information Technology (IT) and Mathematics, so their viewpoint is the most shared and this fact should be taken into account.

In this survey we examine the two main aspects of technology-enhanced teaching: (1) ICT-based devices as a media for knowledge delivery and visualization and (2) traditional learning resources enriched with modern technologies. The first is used to provide a more complete, efficient, dynamic and interesting presentation of audio-visual information relating to the topics being studied. Virtual labs use animations and simulations to demonstrate processes and phenomena in natural sciences and techniques just as augmented reality in humanitarian subjects. The second – technology-enhanced learning resources are non-interactive, reactive or interactive according to the built-in functions and provided feedback concerning knowledge acquisition. The interactivity implies student-centred approach and enables real feedback that supports the learning process.

4. Results and Analysis

4.1. Impact of ICT resources on students' abilities

As many researches state ICT influences humans in almost all aspects, we ask the respondents to consider the impact of ICT-based teaching on students' skills and abilities (Table 1). Roughly

50% of teachers are neutral. This fact indicates that either teachers do not notice any significant change in learners' performance or do not have enough experience to express considered opinion.

It is important to mention that only few teachers spot a negative influence on learners. 51% think that ICT have a positive impact on cognitive abilities, 45% on their psychological characteristics, and 36% see that social abilities and behaviour also benefit from ICT. According to the survey we can summarize skills and abilities that students develop by ICT-based teaching.

Social	Cognitive	Psychological
Communication skills Team working Competitive spirit Relations between generations Safe Internet behaviour	Memorizing Critical & Logical thinking Problem solving Interest to subject matter Knowledge acquisition Visual & Motor functions ICT usage	Motivation Creativity & Imagination Activity in learning Self-confidence Self-dependence Emotional intelligence Excitability

Table 1. Students' skills & abilities developed by ICT-based teaching

More detailed notions can be derived from Fig. 1: 82% of the teachers notice that students start learning effortlessly. 68% observe another positive influence – self-training by exercising and practicing. It is obvious that ICT skills also will benefit from technology- enhanced teaching.

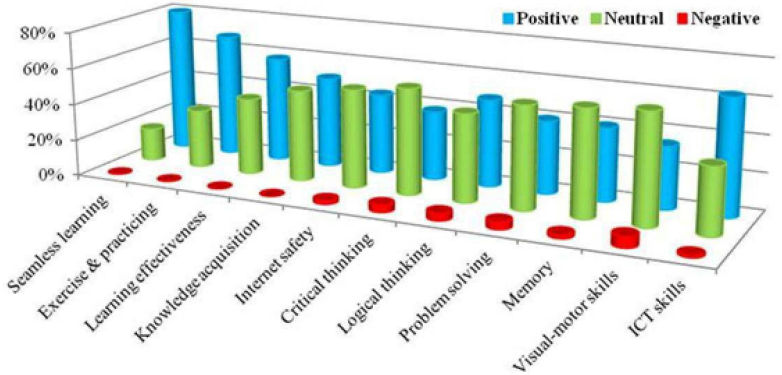


Fig. 1 Influence of ICT on some learning aspects

As a whole, many aspects of learning process take advantage of technology – effectiveness of learning process (58%), knowledge acquisition, logical thinking (each 48%), problem solving (40%) and critical thinking (38%). 44% of respondents believe that Internet safety also increases while using ICT in classrooms. Almost all of teachers think that ICT do not have a negative effect on students, only few of them (6%) consider less physical activities (visual-motor skills). These findings differ slightly compared to survey in (Peycheva-Forsyth, R. 2012). The Internet safety seems to be worse than before and that is a serious problem. Other noticeable changes are positive – the effectiveness of the used ICT in learning process and learning activities rises, which can be a result of better teachers' experience with technology and much more quantity and diversity of available e-learning resources. Acquired ICT skills and competences of the students have also grown compared to aforesaid survey. Problem solving skills are enhanced according to almost the same number of teachers. The ICT-based teaching methods develop the students' abilities and enrich classroom education, and so have a positive effect on educational process.

4.2. Teacher's role in ICT learning resources usage

The technology assisted educational process influences the development of students and their ongoing professional realisation. It is important to take advantage of ICT resources by adapting them to the individual needs. Technologies augment traditional teaching by supporting design of various approaches, educational contexts and sharing experiences to enhance the learning process. The modern education means not changing teaching methods, but offering active ones. This shifts the paradigm: teachers alter their role from information-deliverer to organiser, guide and adviser. Now "facilitator", "teaching differently", "active learning", and "stand back" are the widely used terms describing new teachers' role (Fig. 2).

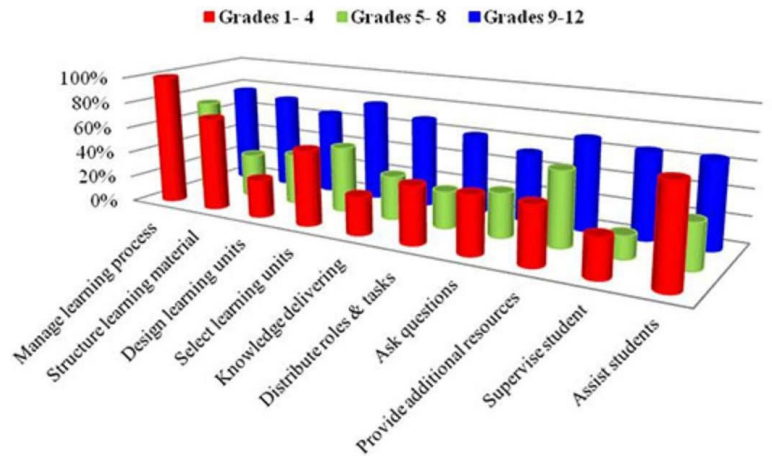


Fig. 2 Teachers' role when using ICT learning resources

There are some differences depending on educational level: teachers in grades 1–4 organise learning process and assist their students more often than at the other grades. The rates in teachers' activities in primary and low secondary level are similar. For the elder learners (grades 9–12) almost all activities have higher rates, because of more often usage of ICT. As a whole, the teachers spend more time on lesson preparation, management of learning process and providing additional resources in technology-enhanced education, regardless of the learners' age.

4.3. Frequency of usage the ICT resources in different education levels

Respondents were asked how often and in what learning contexts they use ICTs (Fig. 3).

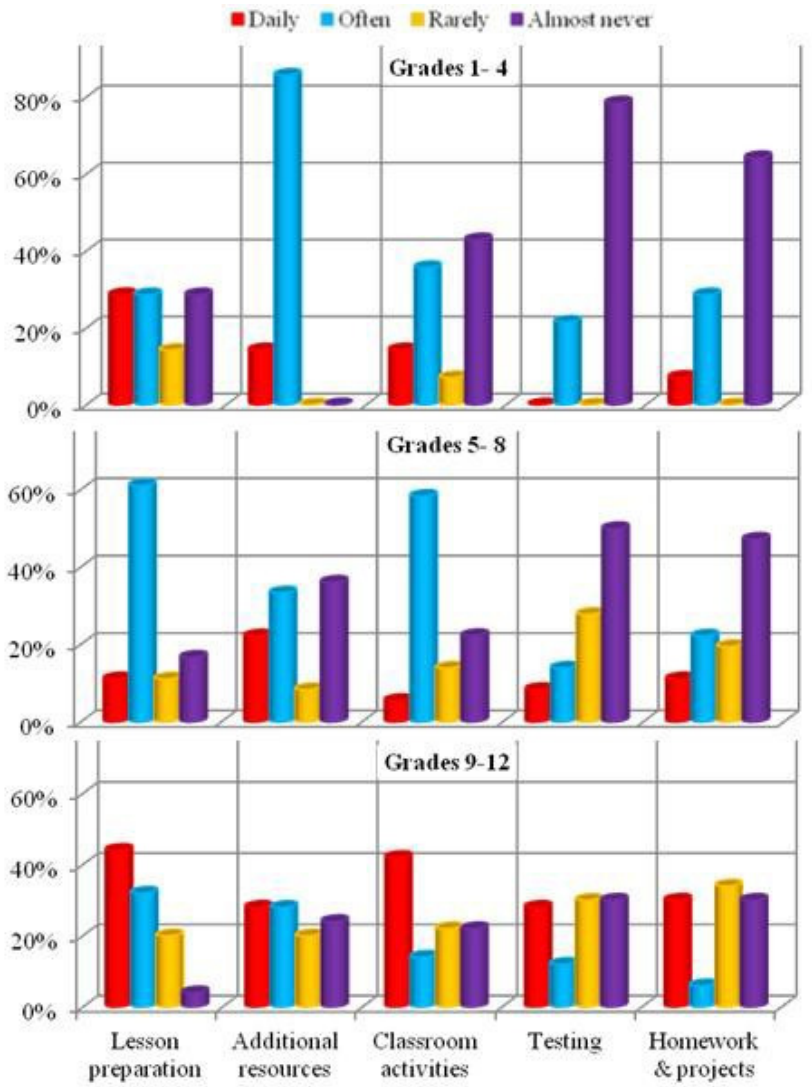


Fig. 3 Frequency of use of ICT resources according to teaching activities and educational levels

Most of primary school teachers frequently use technology tools when searching for additional resources – nearly 86% often and 14% daily. These results indicate that teachers strive to present attractive resources in order to keep pupils' attention. Other cases are in lessons preparation (daily and often at about 29%) and in classroom activities (often

about 36%). Most of the teachers admit that they never use e-learning resources in homework and testing. The situation in the low secondary level changes: the majority of teachers use ICT resources in classroom (60% often, 11% daily) and in lesson preparation (about 60% often), while less of them – for searching additional resources (near 22% daily, 33% often). For under a third of respondents technological resources are useful in testing, homework and projects. The usage of ICT resources in high secondary level is comparatively more frequently: for lesson preparation (44% daily, 32% often), for activities in classroom (42% daily, 14% often) and for searching extra resources (daily and often, each 28%). At that level the most common ICT-based activities are testing, homework and making projects. All these results indicate that quite a lot of the teachers try to use new technology-rich tools and resources in order to present meaningful and up-to-date information to the students, to give more creative and interesting tasks. Nevertheless, many teachers still underestimate the power of technology-based teaching and its influence on the effectiveness.

4.4. Suitable age for introducing ICT-supported teaching

In regard to the appropriate students' age for introducing ICT-based resources in educational process teachers' opinions differ according to educational level where they teach (Fig. 4).

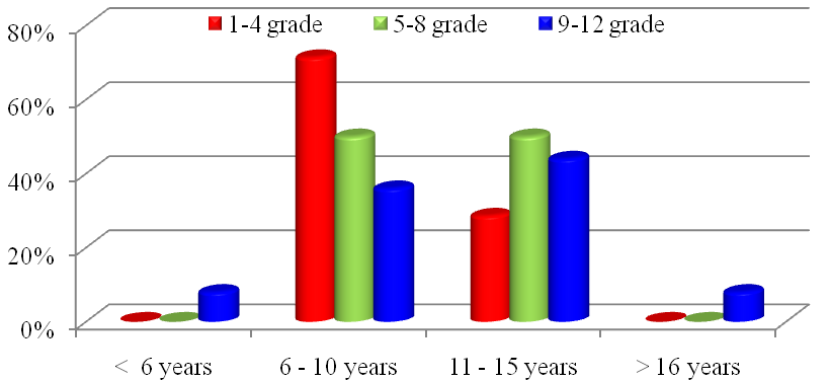


Fig. 4 Teachers' opinion about the appropriate age for introduction of ICT in learning process

About 90% of the respondents consider the need to introduce ICT learning resources no later than grade 8; slightly more of them believe that the application of modern technologies should begin at the primary level, while others think that it is more appropriate in the low secondary level. Above 70% of teachers in primary school say that usage of ICT-based

resources should start at very early school ages, while the teachers of the other stages are more conservative. Altogether, despite some differences of opinions, the findings assert our view that ICT should become part of learning environment in early grades so that the students become easy familiar with it and later on to be able to take advantage of technology-enhanced teaching to the full extent.

4.5. Obstacles

According to the teachers, main barriers to use of ICT-based resources in school are lack of training (43%), lack of technical tools (39%), and lack of appropriate learning resources (36%). The first one implies insufficient or not effective computer literacy training courses. Other obstacles are: price (30%), teachers' attitudes (28%), preparation time (25%), and inconformity of available products to learning matter (16%). Only 4% of the respondents declared that there are no obstacles to usage of ICT. Lack of resources matching to curriculum can be overcome by adapting the available ones, but at the cost of additional time. "The main obstacle (besides lack of technical tools) is the teachers' attitude, many of whom are afraid to use ICT due to lack of training, as well as technological and methodological skills and practice" is a telling opinion.

5. Conclusion

ICT-based teaching has a positive impact on the students. A significant benefit for learners is the opportunity to gain knowledge from alternative sources and through different methods using the various tools provided by the modern technologies. New technologies have the potential to facilitate teachers in customisation of educational tasks and sharing innovative pedagogic practice. The teachers' level of acquiring ICT skills is very important for teaching effectiveness. For a wider expansion of ICTs in Bulgarian schools targeted actions are necessary.

References

[1] Allsop, Y., E. Y. Yildirim, M. Screpanti (2013), Teachers' Beliefs about Game Based Learning: Comparative Study of Pedagogy, Curriculum and Practice in Italy, Turkey and the UK. 7th ECGBL, Porto, pp. 1-10.

[2] Atjonen, P. (2006), Finnish Teachers and Pupils as Users of ICT. Informatics in Education, Vol. 5 No. 2, pp. 167- 182.

[3] Atjonen, P., S. C. Li (2006), ICT in Education in Finland and Hong Kong. An Overview of the Present State of the Educational System at Various Levels. Informatics in Education, Vol. 5, No. 2, pp. 183–194.

[4] Peycheva-Forsyth, R. (2012), The State of ICT Integration in Bulgarian Secondary School – Researcher's Perspective. University Press St. Kliment Ohridski, Sofia.

[5] Prensky, M. (2008), The Role of Technology in Teaching and the Classroom. Educational Technology, Nov.- Dec., pp. 1-3.

[6] Terzieva V., E. Paunova, P. Kademova-Katzarova, Y. Stoimenova (2014), Implementation of ICT-Based Teaching in Bulgarian Schools, EDULEARN'14, Barcelona, pp. 6497-6506.

New aspect of implementing network certification study program in public higher education programs

Dobri Boyadzhiev[1], Pepa Petrova[2]

University of Library Studies and Information Technologies,
119 Tsarigradsko Shosse Blvd., 1784 Sofia, Bulgaria
[1]*d.boyadzhiev@unibit.bg* [2]*p.petrova@unibit.bg*

Abstract

Training in computer network certification program is preferred approach for career development. One of the main ways to implement this approach is realized through academic programs of the world's leading manufacturers of network software and hardware. Universities successfully applied MikroTik RouterOS academic study program usually on small groups of students within three days. However, public education requires working with large groups of students and courses have a minimum duration of one semester. This article proposes a new approach for implementing MikroTik RouterOS academic study program into large groups of students in public higher education. The approach consists of six steps: Step 1 - Curriculum revision, development and improvement; Step 2 – Development of methodological tasks, both for lecture classes and for extracurricular activities; Step 3 - Creating additional mechanisms for motivation; Step 4 - Student preliminary examination; Step 5 – MikroTik RouterOS academic study program online certification. The proposed approach improves implementation of the MikroTik RouterOS academic study program in public higher education. As a result, students who appear for certification have greater success. The proposed approach has been piloted in practice since October 2014. In this article are shown tangible results from the application of MikroTik RouterOS academic study program in higher educational institution in full-time form of education. The approach can be applied in various forms of education in different disciplines.

Keywords:

certification, higher education, study program, MikroTik

1. Introduction

In the world of computer networking among the main approaches used for career development for specialists who have chosen this field of information technologies, certification is one of the most important. Study shows that 72% of employers use IT Certification as a requirement for certain jobs also 65% of IT Employers use certifications to differentiate between equally qualified candidates [1]. One of the common approaches to certification in computer networks is achieved through training courses, composed by world's leading manufacturers of network software and hardware. Often these courses are integrated into the curricula of multiple

universities. The courses usually offer specialized skills and have mechanisms that ensure a certain degree of knowledge of the participated students like certification exam. Such program is the MikroTik RouterOS academic study program – it offers MikroTik Certified Network Associate (MTCNA) course for higher educational institutions. The integration of the program is a serious challenge for state universities because of a number of external and internal factors such as national legislative framework regulations, accreditation requirements and internal regulations of the university as well as specific requirements for the curriculum for teachers and students.

2. MikroTik RouterOS academic study program

Network engineers with a good knowledge in MikroTik RouterOS are being demanded by Internet Service Providers and System Integrators throughout the world. Taking into account that the demand for MikroTik Certified Engineers is constantly increasing, MikroTik is offering higher educational institutions the possibility to organize networking classes using RouterOS as a learning tool. Students may obtain an internationally recognized certificate (MikroTik Certified Network Associate, MTCNA) that confirms their academic credentials. There are different benefits both for students – an opportunity to acquire the basic knowledge in RouterOS and MTCNA certificate during academic studies and for educational institutions –an opportunity to attract more students by offering MikroTik certification [2].

The main requirements for educational institutions which would like to participate include as follows: all the necessary education and professional certifications to participate in the implementation of educational program and grant academic degrees in variety of subjects; motivation and resources students; space and all the equipment needed for the labs (MikroTik can assist in organizing equipment and software); appropriate Internet access; MikroTik Certified Academy Trainer; MikroTik Academy class training materials approved by MikroTik [3]. No extra fees are needed for joining the program except fees for training and certification of the academy trainer.

After analyzing the data from the official website of the program at the time of writing this article educational institutes participating in the MikroTik RouterOS academic study program for higher educational institutions are from 37 countries with a total of 294 educational institutions, distributed by continents as follows: Asia: 197, Europe: 77, Latin America: 14, Africa: 4 and Oceania: 2.

3. ULSIT and the MikroTik academy program

University of Library Studies and Information Technologies (ULSIT) situated in Sofia, Bulgaria is accredited by the National Accreditation and Evaluation Agency to deliver education in Bachelor, Master and Doctoral degrees. It has professional preparation and educational competence and capacity in the field of: Library and Information Sciences, Social Communications; Informatics and Computer Sciences and National Security [4].

After fulfilling the MikroTik RouterOS academic study program requirements ULSIT is the first Bulgarian university who becomes a member of the certification program on June 5, 2014 with signing of an agreement between the University and Mikrotīkls SIA. As up that moment ULSIT added a new department to its university structure: MikroTik Academy in ULSIT headed by certified MikroTik Academy trainer. The main goal [5] of the MikroTik Academy in ULSIT is to conduct an effective profiled education of specialists in computer networks built with products and MikroTik solutions. Main objectives of MikroTik Academy in ULSIT are defined as follows:

- **Quality in education**: To achieve a new quality in education in accordance with the principles of the Strategy for effective implementation of ICT in education and science in the Republic of Bulgaria (2014-2020);
- **New curriculum**: To develop and implement a curriculum aligned with the criteria of the MikroTik RouterOS academic study program for higher educational institutions by applying national and international educational best practices and standards;
- **Effective trainings**: To train new perspective specialists in computer networks necessary for Bulgarian and European labour market;
- **Better practical exercises**: To develop a specialized educational and scientific infrastructure to conduct systematic theoretical courses and practical exercises;
- **Specialized infrastructure**: To create an information and communications infrastructure for self-learning and knowledge sharing;
- **Business-education partnerships**: To establish relationships with businesses aimed at training and research, career development, socialization and integration among ICT experts.

4. New approach and recent results

The traditional method of implementation of MikroTik RouterOS study program, when it was used for training big groups of full-time students,

produced unsatisfactory results. The key issues that were noted after first training course were related to the structure of the curriculum, lack of enough practical task, problems with motivation, lack of an adequate initial assessment and self-assessment, problems during certification exam, etc. Because of the unsatisfying result, new approaches for implementation of the program were applied. They were divided into five main steps briefly described below.

4.1. Curriculum revision, development and improvement

MikroTik academy program can be classified as liberal because it provides only a general curriculum framework and recommended the structure of instructional materials, but it gives the opportunity to the instructors for creating their own course. The latest version of the proposed curriculum (training outline) recommends training in 9 modules for a period of three days. Training of full-time students in ULSIT however is implemented within 12-13 weeks per semester and the provided training course involves 15 hours of lectures and 30 hours of exercises. This implies developing a new curriculum that builds a different logical structure of completed modules with suitable logical connections, increasing the presented study material for lectures and developing a methodology for conducting much more exercises. All this led to the development of new curriculum.

4.2. Development of methodological tasks

Project-based learning methodology is applied both for in classes exercises and for extracurricular activities. The course starts with declaring project requirements witch main goal is to design and construct a network topology that includes specific theoretical and practical knowledge of all training modules. The ultimate goal of the students is to deal with real-world challenges and problems. For in class exercises there are developed number of tasks directly related to the past lecture and logically associated with the project. For extracurricular activities there have been developed more complex practical tasks that require further study and testing. Due to work with a large number of students learning management system Google Classroom is used. It provides flexibility in the matter of ongoing auditorium exercises and extracurricular tasks, control the process pre-evaluation and tools for communication as well as mobile application for modern productivity.

4.3. Creating additional mechanisms for motivation

Dedicated educators are always on the lookout for ways to improve teaching and learning. In recent years, technology driven innovations such as smart boards, iPads, and online courses have greatly facilitated both. But

it's really technology in the service of psychology that gets students to engage with and absorb new material [6]. Some of the principles of competitive learning model are applied in the class. For extra motivation class-ranking is made. At the end of the course the three students received the best results during the training and certification are awarded with a MikroTik router. The routers are provided by an MikroTik official distributor for Bulgaria as a sponsorship. All the results are made evaluable publicly trough MikroTik Academy at ULSIT official web site, social networks etc.

4.4. Student preliminary examination

Preliminary assessment of course participant's knowledge is an important step that allows tracking the progress of each student and shows the strengths and weaknesses of its development. This is achieved by developing a database with more than 200 questions distributed by modules and used for conducting two major preliminary exams during the semester before the certification exam. Questions are developed with a clear practical purpose and are more about practical issues, supported by network diagrams, configuration exports and more visual scenarios. During preliminary examinations each student is provided access to physical and virtual router and it is recommended to use it for solving most of the exam tasks. Tests and analysis of results are made through computer-based exam system which is allowing fast, more informed decision-making about changes in the learning process. That is used for individual assessment of each student.

4.5. MikroTik RouterOS academic study program online certification

The successful conduct of the certification online exam in the MikroTik examination platform for large group of students requires careful planning and preparation. Due to security measures before the exam, verification of each student is needed as well as photo shooting of the participants. Besides a detailed instruction about the rules of the examination it is required well-equipped classroom that offers workstation for each student, router and Internet connection with failover.

To be eligible for official MikroTik online certification exam an internal policy is made: only students who have activity participated in all lectures, in class exercises, solved all extracurricular tasks and achieved score more than 75% of preliminary exams are admitted.

This article represents a research which took place in a Bulgarian public university and include 120 students in the period of two years in full-time form of education, half of them were trained under a new approach

described above in the 12-week certificate course at the university. The result represents that new proposed approach for implementing MikroTik RouterOS academic study program into large groups of students in public higher education leads to better result in a certification success rate and higher average exam scores (fig.1).

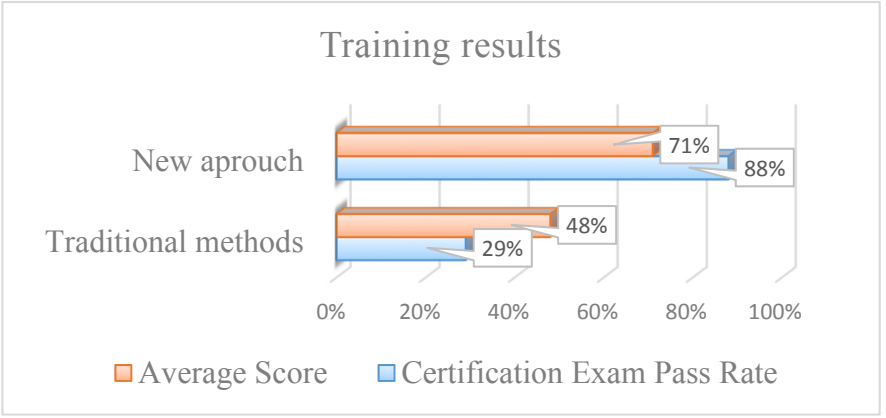


Fig.1 The results of training before and after applying new approach

5. Conclusion

Each higher education system has its own distinctive features, specific problems and issues related to international, national and local regulations, accreditation requirements and also specific requirements of students, teachers, researchers and institutional leaders. Many technology companies as well as world's leading manufacturers of network software and hardware develop their own training course witch are offered to the universities as study programs. But because of the distinctive features of each higher education institution implementation of any certification program needs adoption. As is shown in this article, using new approach for implementation of MikroTik RouterOS academic study program bring benefits for students, universities and for business too. The business will have students ready in short time for work. The proposed approach improves adaption of the MikroTik RouterOS academic study program in public higher education.

References

[1] Foote Partners. (2015) "IT Skills + Certification Pay Index.", available at: http://www.footepartners.com/htscpi_latest.htm (accessed 3 March 2015).

[2] Mikrotīkls SIA, (accessed 12 February 2016). "MikroTik RouterOS Academic Study Program for Higher Educational Institutions", available at: http://www.mikrotik.com/download/share/Academy_PDF.pdf

[3] Mikrotīkls SIA, (accessed 16 April 2016), "MikroTik Training events and institutions around the world", available at: http://www.mikrotik.com/training/academy

[4] UNESCO Chair, (accessed 20 April 2016), "University of Library Studies and Information Technologies (ULSIT)", available at: https://unesco.unibit.bg/sites/default/files/2015 FLAYER SULSIT and UNESCO CHAIR.pdf

[5] Boyadzhiev, D. (2014), "About MikroTik Academy at ULSIT", available at: https://mikrotik.unibit.bg/mikrotik-academy/about-mikrotik-academy/ (accessed 1 May 2016).

[6] Plaza, C. (2014) Motivation in Education, available at: ttp://awo.aws.org/2014/08/motivation-in-education/ (accessed 5 May 2016).

The Public Library Services in Turkey and Bulgaria: Comparative Findings and Recommendations

Ahmet Altay[1], Tania Todorova[2], Ivanka Yankova[3]

[1]Kirklareli University, Turkey
ahmetaltay57@hotmail.com

[2,3]University of Library Studies and Information Technologies, Bulgaria
[2]t.todorova@unibit.bg, [3]i.yankova@unibit.bg

Abstract

This paper presents the comparative findings and recommendations from the realized in 2014 survey in the systems of public libraries in Turkey and Bulgaria. The main aim of this research is to determine the current situations of public libraries in Turkey and Bulgaria; and, under the light of the data derived, to provide proposals and recommendations for improvements and future strategies development. It is also aimed to find out the effects of the lifelong learning and information literacy conceptions, the information and communication technologies implementation, the automation and digitization activities, which have in general become the agendas of public libraries as a key partner of the society development. Another important goal of the study is to find out the opinions of the library managers and librarians, which work in the public libraries in Turkey and Bulgaria, about the fact of information society and about the effects of the information society on the public libraries. The survey covered the 81 public libraries in Turkey and 277 librarians and library managers in these libraries, and 28 regional public libraries in Bulgaria and 136 librarians and library managers. The survey instrument, which includes 79 questions, has been created via Surveymonkey (www.surveymonkey.com), on Bulgarian and Turkish languages, and was sent to the Turkish and Bulgarian respondents via e-mails.

Turkey and Bulgaria have been selected as the independent variables in order to find out the differences in the opinions about the effects of the phenomenon of information society on the public libraries. In this context, the change and evolution in the main elements and services in the passing process of the public libraries were comparatively discussed. As a result from the analysis, there are made twenty two suggestions for further improvements, which are presented on the attention of the library communities and all stakeholders in both countries. The public libraries in Turkey and Bulgaria must reconsider and redefine their service policies in accordance with the requirements of the information society.

Keywords:

Public Library Services, Turkey, Bulgaria, Comparative Study, Information Society

1. Introduction

The libraries, dating back to the invention of the letters and in the current process, have been exposed to various revolutions and changes in terms of both the main elements and the services they give. The period which has seen the most rapid change is the period from the second half of 20th century till nowadays, which is also identified as the information society or information age. One of the libraries that has been affected by this rapid change and evolution process is the public libraries. It is not possible for the public libraries, which is one of the important social institutions, to be unconcerned to the change wave existed in the society. The public libraries both affect and are affected by the society in which they exist. As a result, as passing to the process of the information society, there were fundamental changes and revolutions in the user services, technical services and managerial services which are the main services of the public libraries. Besides, there were fundamental changes and revolutions in the collection, staff, buildings and budges of the public libraries. Besides, the public libraries, whose main aim is to give and spread the information to the society it gives services, have been the institutions affecting and shaping the information society based on "information" without making any kind of discriminations.

From now on the public libraries will be exposed to the changes depending on the social revolutions as it is today. In other words, the public libraries will change as long as the society in which they exist changes. However, it is a fact that no matter what happens, the service philosophy and the reasons for their existence will not ever change. The public libraries will always be the social institutions that give cultural, educational and information service to every citizen. In this context, as passing to the process of the information society, it is possible to say that the most important and crucial functions of the public libraries are to synthesize the facilities provided by the information society toward the services and elements of the public libraries with traditional service philosophy and missions.

In addition to be two neighbour countries, Turkey and Bulgaria have the common historical and cultural heritage. The people of these two countries lived under the roof of the Ottoman State five hundred years. As a result of this cohabitation, a lot of similarities occured ranking from the religious life to the daily life such as language, tradition and custom. There are similarities in the social development of Turkey and Bulgaria. Both of these countries past the period of agriculture very well but had some problems on passing the industrialization period. Both of these countries faced the information society before completing the industrialization period and had

to make some preparatory activities for the requirements of the information society.

In this study the *public libraries in Turkey and Bulgaria have been handled with a comparative approach*. Turkey and Bulgaria have been selected as the independent variables in order to find out the *differences in the opinions about the effects of the phenomenon of information society on the public libraries*. In this context, the change and evolution in the main elements and services in the passing process of the public libraries were comparatively discussed.

2. Public Library Systems in Turkey and Bulgaria

Public libraries are the institutions which are being shaped depending on the social, economic, cultural, administrative, political and other conditions of the country they are placed (Yılmaz, B. 1996: 3). As a result of the central administration weighted public administration structure in Turkey, a great deal of the libraries providing public library service are implementing their services as being connected to the General Directorate of Libraries and Publications which is one of the main service units of Ministry of Culture and Tourism. The services of these libraries are planned by the General Directorate of Libraries and Publications; the financing, personnel, collection, and building needed for this service are provided by the same unit; the activities such as constituting strategy, standards, legal structure, inspection, new service areas are centrally put into practice. (Faydalıgül, O. and Yılmaz, B. 2012; Karadeniz, S. 2012; Keseroğlu, H. 2004; Yılmaz, B. 2005; Yılmaz, B. 2010).

There are also public libraries in Turkey established by local governments. Especially in recent years, the fact that the public libraries founded in developed metropolitans such as İstanbul, Ankara, İzmir, Adana, Bursa, Diyarbakır and etc. by municipalities has become common more and more. However, the public libraries serving as connected to the General Directorate of Libraries and Publications are larger in number comparing with the libraries established by local governments, and have a common network. In other words, even though there are public libraries in Turkey established by local governments, the Public Library system is predominantly central.

According to the data of 2015, under the provincial organization which is connected to the General Directorate of Libraries and Publications, 1130 public and children's libraries, 6 literature museum libraries and 31 bookmobiles serve (KYGM 2016).

The system and organization of public libraries in Bulgaria have been structured within the scope of the *Law of Public Libraries in Bulgaria* (2009). According to this law, the public libraries are defined on four groups as: National Library, Regional libraries, Municipality libraries and Chitalishte public libraries. All of these libraries provide their services within an established national network (Doncheva, A. *et. al.* 2014).

St. St. Cyril and Methodius National Library in Sofia is the largest public library in Bulgaria and the main methodological center of the public library network. The National Library works coordinately with other public libraries and constitutes the backbone of the National information services. There are *Regional Public Libraries*, which provide public library service in the center town of the 28 regions of the country. In many towns there are *Municipality libraries*, also. All these libraries financed and developed by government and local administrations. *Chitalisthte Public Libraries* are defined as unprecedented Bulgarian phenomenon and whose history goes back to 19th century and formed an important part of Bulgarian public library system. These libraries which are organised and developed by the public are important local cultural and educational institutions in Bulgaria. There are Chitalishte libraries in each town, even almost in each village in Bulgaria. Bulgarian Ministry of Culture gave the methodological guidance and coordination responsibility of the public libraries' network on national level (Bulgarian 2014; Denchev *et. al.* 2006; Doncheva, A. *et. al.* 2014; Yankova, 2004).

3. Survey implementation

3.1. The Aim and Background

The main aim of this research is to determine the current situations of public libraries in Turkey and Bulgaria; and, under the light of the data derived, to provide proposals and recommendations for improvements and future strategies development. It is also aimed to find out the effects of the lifelong learning and information literacy conceptions, the information and communication technologies (ICT) implementation, the automation and digitization activities, which have in general become the agendas of public libraries as a key partner of the society development. Another important goal of the study is to find out the opinions of the library managers and librarians, which work in the public libraries in Turkey and Bulgaria, about the fact of information society and about the effects of the information society on the public libraries.

3.2. Demographics

The survey covered the 81 public libraries in Turkey and 277 librarians and library managers in these libraries, and 28 regional public libraries in Bulgaria and 136 librarians and library managers. The survey instrument, which includes 79 questions, has been created.

3.3. Methodology

The survey questionnaire has been used to gain the datas related to the opinions of the managers and librarians working in the city public libraries in Turkey and the regional public libraries in Bulgaria about the information society phenomenon and its effect on the public libraries.

The survey was uploaded to the link (https://tr.surveymonkey.com/s/H25BBVP) via Surveymonkey (www.surveymonkey.com), which is web-based survey software, in Bulgarian and Turkish language and was sent to the libraries of Turkish and Bulgarian participants via e-mail (https://tr.surveymonkey.com/s/H25BBVP). The invitation for the online survey were firstly sent to the e-mail addresses of the respondents on 18th February 2014 and till 18th March 2014 - 74 participants from Turkey and 49 participants from Bulgaria answered the whole survey. On 18th March 2014 the survey was sent to the participants for the second time and a month later was closed. Until 18th April 2014 from the survey were obtained the total number of the answers as follows: *156 participants from 81 city public libraries in Turkey and 78 participants from 28 regional public libraries in Bulgaria*.

The data obtained were subjected to logical verification and control and then processed through the statistical package SPSS (Statistical Package for the Social Sciences). For specification of the psychometric characteristics of the methods and verification of the hypotheses, other statistical processing methods were also applied: descriptive statistics; correlation analysis; factor analysis; single-factor dispersion analysis.

4. Comparative findings

In this part of the study, the results of the survey study, on determining the opinions of managers, vice-managers and librarians in the public library in Turkey and Bulgaria related to the position and role of public libraries in the information age, will be analyzed. 1.2 Findings about current development and conditions in Public libraries

Table 1. *Views of Library Directors and Librarians about Current Conditions in Public Libraries*

	C	1	2	3	4	5	A	S	T	P

Statement		Nu	%	Nu	%	Nu	%	Nu	%	Nu	%			De	De
Our library collection is competent to meet the needs of the information society	Turkey	9	5,8	32	20,5	22	14,1	82	52,6	11	7,1	3,34	1,06		
	Bulgaria	2	2,6	4	5,1	6	7,7	51	65,4	15	19,2	3,93	0,842	-4,612	0
The e-publications in our library is satisfactory (e-book, e-magazines and databases)	Turkey	56	35,9	79	50,6	11	7,1	8	5,1	2	1,3	1,85	0,85		
	Bulgaria	17	21,8	42	53,8	9	11,5	9	11,5	1	1,3	2,16	0,94	-2,554	0,011
Our library is competent enough to meet the needs of the users of information society	Turkey	11	7,1	45	28,8	26	16,7	67	42,9	7	4,5	3,08	1,08		
	Bulgaria	0	0	3	3,8	19	24,4	46	59	10	12,8	3,8	0,7	-6,089	0
The qualities/skills of the staff in our library are sufficient to provide a modern public library service in an information society	Turkey	32	20,5	67	42,9	18	11,5	33	21,2	6	3,8	2,44	1,14		
	Bulgaria	2	2,6	6	7,7	14	17,9	41	52,6	15	19,2	3,78	0,94	-8,882	0
The service units of our library should be reorganized	Turkey	4	2,6	13	8,3	13	8,3	77	49,4	49	31,4	3,98	0,98		

due to the developments in information society and information technologies.	Bulgaria	1	1,3	7	9	12	15,4	41	52,6	17	21,8	3,84	0,91	1,085	0,279
The digital technology and practices used in library are sufficient.	Turkey	23	14,7	90	57,7	25	16	16	10,3	2	1,3	2,25	0,87		
	Bulgaria	7	9	20	25,6	14	17,9	29	37,2	8	10,3	3,14	1,18	-5,843	0
Our library keeps up with the innovations in information and communication technologies and applies them.	Turkey	13	8,3	46	29,5	38	24,4	52	33,3	7	4,5	2,96	1,07		
	Bulgaria	2	2,6	5	6,4	10	12,8	52	66,7	9	11,5	3,78	0,83	-6,441	0
The internet and social media applications dealing the announcement of the activities and public relations works organized in our library are sufficient.	Turkey	15	9,6	53	34	28	17,9	51	32,7	9	5,8	2,91	1,13		
	Bulgaria	2	2,6	7	9	4	5,1	47	60,3	18	23,1	3,,92	0,93	-7,26	0
There is corporation with NGO, organizations, foundation etc. in the applications made in our library.	Turkey	11	7,1	43	27,6	22	14,1	67	42,9	13	8,3	3,17	1,13		
	Bulgaria	0	0	0	0	8	10,3	41	52,6	29	37,2	4,26	0,63	-9,368	0
In the technical tasks done in our library, the	Turkey	7	4,5	21	13,5	22	14,1	81	51,9	25	16	3,61	1,05		

developments in information technology are followed and applied.	Bulgaria	2	2,6	5	6,4	4	5,1	45	57,7	22	28,2	4,02	0,91	-3,082	0
While making up library budget, new information technology applications and usage are considered.	Turkey	17	10,9	48	30,8	30	19,2	51	32,7	10	6,4	2,92	1,15		
	Bulgaria	5	6,4	19	24,4	21	26,9	25	32,1	8	10,3	3,15	1,1	-1,422	0,156
The life long learning activities organized in our library are sufficient.	Turkey	19	12,2	70	44,9	39	25	24	15,4	4	2,6	2,51	0,98		
	Bulgaria	3	3,8	11	14,1	18	23,1	31	39,7	15	19,2	3,56	1,07	-7,482	0
The information literacy activities organized in our library are sufficient.	Turkey	13	8,3	69	44,2	26	16,7	41	26,3	7	4,5	2,74	1,07		
	Bulgaria	2	2,6	5	6,4	16	20,5	42	53,8	13	16,7	3,75	0,9	-7,149	0

More than half of the librarians and library managers in Turkey (59.7 percent) agree on the statement that*"Our library's collection is competent to meet the needs of the information society"*. It is seen that the participation of the librarians and library managers in Bulgaria is higher than the ones in Turkey (84.6 percent). The frequency average of participants on this question for Turkey is 3.34; in Bulgaria is 3.93. The respondents positive attitude to the statement *"The number of e-publications (e-magazine, e-book, databases) is satisfactory"* is very low. 71.2 percent of the participants in Turkey think that the number of non-book materials in Turkey is not satisfactory and 86.5 percent think that the number of e-publications is not satisfactory. The viewpoints of the Bulgarian librarians and library managers are not different from their colleagues in Turkey. 57.7 percent of the Bulgarian survey participants do not consider the number of the non-book materials in their libraries as satisfactory and 75.6 percent do not consider the number of e-publications as satisfactory. This negative viewpoint also affects the frequency

averages of the answers. As it is seen from the Table 1 that the frequency averages of each two questions is extremely low.

The statement about the opinions of the respondents related to the current situation of the libraries in terms of quality of information services for users have been provided: *"Our library is sufficient to meet the needs of information society users"*. When the participation level is considered, the opinions of Bulgarian participants are more positive than the ones in Turkey.

Looking at the answers given to such expressions as *"The qualities/skills of the staff in our library are sufficient to provide a modern public library service in an information society"*, it is seen that there is a considerable difference in the level of unanimity between Bulgarian and Turkish participants. For the three questions, the unanimity level of Turkish participants is low. This difference in the level of unanimity is also statistically meaningful ($p<0,05$).

With a frequency average of 3.98 for the statement *"The service units of our library should be reorganized due to the developments in the information society and information technologies"*. It is seen that the Bulgarian participants, with a high average of frequency (3.84), believe that the service units in their libraries should be reorganized depending on the developing technology. However, with a frequency average of 4.21, the high level of unanimity of the Turkish participants is stand out.

Concerning the sufficiency of digital technology applications and digitalization processes implementation at their libraries, as understood from the Table 1, Turkish participants have a more negative point of view than their Bulgarian counterparts. The research of Todorova et. al. showed the commonalities and differences in the situation of presentation of cultural heritage on digital environment in Bulgaria and Turkey. These authors observed major common problems as lack of national strategies, authorized aggregators, standards and coordination on digitization process (Todorova *et. al.* 2016).

While the frequency average of Turkish participants was 2.96 for the statement *"Our library keeps up with the innovations in information and communication technologies and applies them"*, the frequency average of Bulgarian participants was 3.78. It is clear that Bulgarian participants have a higher rate of agreement with this statement. From the Table 1, it is also understood that the Bulgarian participants believe, at a higher rate than Turkish ones, that their libraries produce new strategies in order to keep up with the developing technology (TR=3.03 - BG=3.76).

That the Bulgarian participants have a quite high level of agreement with the two statements asked to determine the views of participants about the

use of information technologies and internet in socio-cultural activities and public relations works organized in their libraries attracts attention. The rate of unanimity percentage of the Bulgarian participants for the statement *"The internet and social media applications dealt with the announcement and share of the activities and public relations works organized in our library are sufficient"* was 83.1%. The agreement percentage of the Turkish participants with this statement was however, only 38.5%.

When looked at the unanimity rates for the statements *"In the applications carried out in our library, nongovernmental organizations, associations, foundations, and similar institutions are in cooperation"* and *"There is a transparent and open administrative mentality based on reliance in our library"*, it is seen that the Bulgarian participants have a higher rate of unanimity than the Turkish ones. The frequency average of the Bulgarian participants for both of the questions is over 4. The difference in the unanimity level of the Turkish and Bulgarian participants is also statistically significant ($p<0,05$).

When the replies given for the statements *"In the technical works done in our library, the developments in information technology is pursued and applied"* and *"In the technical works implemented in our library, information and communication technologies are utilized at the utmost level"* are evaluated, we can say that the point of view of the participants in both countries concerning the matter is positive. It is also obviously seen that the Bulgarian participants have a higher level of agreement with the use of information technologies in technical works in their libraries. This difference in the unanimity level is also statistically significant ($p<0,05$).

For the statement *"While constituting library budget, new information technologies applications and their usage should be considered"*, however, the unanimity level of the Bulgarian participants are seen to be higher than the Turkish ones TR=2.92 – BG=3.15). This difference is also statistically significant ($p<0,5$).

However, it is salient that the Turkish participants have a much more negative opinion (TR=2.51 – BG=3.56) than their Bulgarian counterparts for the statement *"The lifelong learning activities organized in our library are sufficient"*. It is rather meaningful that the percentage of the Turkish participants who agreed with this statement is only 18 percent. The unanimity difference for this statement is also statistically meaningful ($p<0,05$).

4.2 Findings about the impacts of information society on public libraries

In this *section*, the views of Turkish and Bulgarian participants on *information society and public libraries* have been handled. In **Table 2,** there are frequency distributions, (numerically and by percentage), frequency averages that include *the views of the Turkish and Bulgarian participants on the impacts of information society on public libraries*, and standard deviation values of the answers. In addition, there are *t* and *p* values obtained as a result of *t-test* achieved considering country variable in the Table 2.

Table 2. *Views of Library Directors and Librarians on Information Society*

Statement	Country	1		2		3		4		5		Ave.	St. Deg.	t	p
		Num.	%	Num.	%	Num.	%	Num.	%	Sayı	%				
The development difference between libraries will decline with the process of transition to information society	Turkey	4	2,6	13	8,3	18	11,5	89	57,1	32	20,5	3,84	0,93	3,058	0,003
	Bulgaria	1	1,3	8	10,3	29	37,2	33	42,3	7	9	3,47	0,84		
Interlibrary coordination and cooperation will rise with the process of transition to information society.	Turkey	0	0	6	3,8	12	7,7	96	61,5	42	26,9	4,11	0,69	1,901	0,059
	Bulgaria	0	0	3	3,8	11	14,1	52	66,7	12	15,4	3,93	0,67		
Consultation facilities about the process and technical services in libraries will increase with the process of transition to information society.	Turkey	1	0,6	2	1,3	15	9,6	98	62,8	40	25,6	4,11	0,67	1,562	0,12
	Bulgaria	1	1,3	2	2,6	10	12,8	51	65,4	14	17,9	3,96	0,72		
The possibilities of developing international politics, strategy and standard have increased for public libraries with the process of transition to information society.	Turkey	4	2,6	11	7,1	34	21,8	85	54,5	22	14,1	3,7	0,88	-2,227	0,027
	Bulgaria	2	2,6	2	2,6	10	12,8	46	59	18	23,1	3,97	0,83		

Internal and external supervision possibilities have increased for public libraries with the process of transition to information society.	Turkey	2	1,3	17	10,9	27	17,3	90	57,7	20	12,8	3,69	0,87	-1,15	0,257					
	Bulgaria	1	1,3	3	3,8	19	24,4	40	51,3	15	19,2	3,83	0,82							
The roles of professional associations in public libraries will rise with the process of transition to information society.	Turkey	0	0	12	7,7	15	9,6	99	63,5	30	19,2	3,94	0,77	0,282	0,778					
	Bulgaria	2	2,6	2	2,6	13	16,7	45	57,7	16	20,5	3,91	0,84							
The local qualities of public libraries should be strong in the process of transition to information society.	Turkey	1	0,6	3	1,9	8	5,1	94	60,3	50	32,1	4,21	0,68	2,057	0,042					
	Bulgaria	1	1,3	5	6,4	11	14,1	39	50	22	28,2	3,97	0,89							
Our library has the sufficient qualities/specialities to serve in information society.	Turkey	11	7,1	51	32,7	28	17,9	62	39,7	4	2,6	2,98	1,05	-6,908	0					
	Bulgaria	0	0	3	3,8	20	25,6	35	44,9	20	25,6	3,92	0,81							

When it is looked at the level of unanimity for the statement "With the process of transition to information society, the development difference among the libraries will decrease", it can be said that the participants in both countries have a positive point of view about this issue. It is salient that the rate of unanimity of the Turkish participants is considerably higher than their Bulgarian counterparts (TR= 3.84 –BG=3.47). From the answers in the Table 2, it is understood that the librarians and library directors in Turkey and Bulgaria believe to a large extent that the local qualities of public libraries should be strong with the process of transition to information society (TR= 4.21 –BG=3.97). In this statement it is apparent that the Turkish participants have a higher rate of unanimity than their Bulgarian counterparts. The difference at the level of unanimity of the librarians and library directors within two countries with the both statements is also statistically significant (p<0,05).

In both countries, for the statements, "With the process of transition to information society, interlibrary coordination and cooperation will increase" and "With the process of transition to information society, advisory facilities about technical support will rise in the procedures and services", there has been a high rate of unanimity. While the unanimity rate of the Turkish participants was 4.11 for both questions, the average of the participants in Bulgaria was 3.93 for the first

statement and 3.96 for the second one. From the Table 2, it is obvious that the participants from both countries mostly believe that the role of the vocational organizations in public libraries will increase with the transition to information society (TR= 3.94 –BG=3.91). As seen, even if the frequency averages of the Turkish and Bulgarian participants for three statements are very close to each other, the unanimity percentages of the Turkish participants are more apparent than their Bulgarian counterparts. Indeed, the p values in front of the expressions show that there is no significant difference among the participants.

For the statement, "With the transition to information society, the possibilities of developing politics, strategies and standard for public libraries have increased at an international level", however, it is conspicuous that the Bulgarian participants displayed a higher rate of unanimity (TR= 3.70 –BG=3.90) than the Turkish librarians and library directors. The difference between the two countries' participants (p<0,05) is statistically significant as well. For the statement "With the process of transition to information society, internal and external supervision possibilities for public libraries have risen", however, even though the unanimity of the Bulgarian library directors and librarians is higher than the Turkish ones with a slight difference, the frequency averages of both countries (TR= 3.69 –BG=3.83) are very close to each other. 0,257 p value obtained from the answers proves that there is no significant difference between the two variables.

In this section, from the answers taken for the most critical statement "Our library has the sufficient qualities/peculiarities to provide service in the information society", it is seen that the approach of the Bulgarian participant to this subject is rather positive comparing with the Turkish ones (TR= 2.98 –BG=3.92). In other words, a great deal of the Turkish participants believes that their libraries do not have sufficient qualities for information society. The p value (0,000) obtained from the replies given for the statement reveals the significant difference between the variables.

5. Suggestions and Recommendations

Generally speaking on the study, it is possible to say that the participants from Turkey and Bulgaria highly attend the questions toward determining the necessary aspects and qualities of the public libraries and library staff in the information society. In other words, the approaches of the participants from both countries on the necessary aspects and qualities that the public libraries of the information society and their staff must get are positive and closed to each other. However, it is seen that the attendance level of the participants especially from Turkey about the current situation of the human sources in the public libraries is very low. It is seen that the attendance level of the Bulgarian participants is higher than the one of Turkish participants.

The suggestions and recommendations shown below have been developed within the results above and the study:

1. *The collection development policies* in the public libraries in Turkey and Bulgaria must be reconsidered, the innovations depending on the rapid technology in the information society must be reflected into the collections of the public libraries. In this context, the studies toward *enriching, updating and renewing* the collections, databases, e-book, e-magazine, non-book materials such as DVD, VCD, CD, CD-ROM must be started.
2. Emergently, concrete steps must be taken to supply the need in the number of *staff and librarians* in the public libraries of Turkey. Especially, the lackness in the number of the librarians in the public libraries has resulted in the insufficient and unqualified services in the libraries. In this context, *the regulation of the public libraries* that entered into force has positive items. Unfortunately, there is no concrete step toward the need of human sources in the public libraries. The studies that will be carried out in this field are very crucial in terms of the future and development of the public libraries inTurkey.
3. The studies toward the *employment of experts in various fields* such as philology, public relation, psychology consultation, ethnology, folklore etc. in both countries' public libraries must be made.
4. The number of the *computers for the users* in the public libraries in Turkey and Bulgaria must be increased. The *modernization and renewal of the ICT and technical equipment* in both countries' public libraries must be made after the technological developments. The new computer technologies such as laptop, notebook, tablet, e-book reader will increase the attention to the public libraries. The obligation of the unencrypted and unhindered wireless internet service in the public libraries of Turkey and Bulgaria is our another suggestion on this issue. If this kind of application becomes compulsary in the public libraries, the users have the oppurtunity of a free and unlimited internet usage via their personal computers and mobile phones.
5. The applications and studies toward *digitization in both countries' public libraries* must be supported. Many public libraries do not have any infrastructures and equipments for the digitization studies in Turkey and Bulgaria. The infrastructure studies toward the digitization in these libraries must be started and the necessary equipments must be supplied. The current infrastructure and equipments in the libraries that have carried

out the digitization process with the limited opportunities must be modernized. Especially, the studies toward the *digitization of the local cultural elements* are very important for the mission and roles of the public libraries in the information society.

6. The studies and projects toward *open access in the public libraries* of Turkey and Bulgaria must be supported. The studies toward open access in both countries' public libraries will supply opportunities in terms of presenting the local and national sources to universal usage.
7. In the main services presented in the public libraries of Turkey and Bulgaria, the renewals and developments in the technology must be utilized. Besides, the current applications and materials depending on the ICT in the field of librarianship must be followed and used in the public libraries. The *e-services* presented to the usage of the users in both countries' public libraries must be developed and common.
8. The use of *social media and web paging* in the public libraries of Turkey and Bulgaria must be common. In addition to this, the principle, standard and policies toward the use of social media and web paging in both countries' public libraries must be created.
9. The studies toward the *enforcement of the weak local aspects* of the public libraries in Turkey must be carried out. The studies of the General Directorate of the Libraries and Publishments to which the public libraries in Turkey are tied up will not be enough. In this process, the supports of the public library staff and managers, local administrations and civil society institutions are crucial. In other words, the public libraries' in Turkey gaining a powerful local identity is possible with the coordination and cooperation among the General Directorate of Libraries and Publishments, Public Libraries, local administrations and civil society institutions.
10. The studies toward the renewal and updating of the technological equipment in the public libraries in Turkey and Bulgaria must be made. New regulations must be made in the *service offices* of the libraries and even new service offices must be added depending on the social development and revolution. The service buildings must be reorganized depending on the developments in information society and technologies in both countries' public libraries. Besides, *the new public libraries that will be established* in

both countries must be organized in accordance with a modern understanding and technology that the information society needs.

11. The studies toward increasing the number of the *mobile libraries and mobile library services* must be made. The studies that will be done in Bulgaria are very crucial. Since it is seen that the current situation about the mobile library in Bulgaria is worse than the one in Turkey.
12. The *services given to kids, teenagers and special groups* such as homeless, prisoners, emigrants, minorities, and disabled must be developed. The creative services that will be developed for these groups will strenghten the place of public libraries in the society.
13. The cooperation with *the local administrations, civil society institutions and private sector* in the activities, projects and services in the public libraries must be increased. It mustn't be forgotten that with this kind of cooperation, small budgets and opportunities the public libraries can carry out great projects.
14. While creating the budgets of the public libraries the renewals in ICT must be reconsidered. It is compulsary for the public libraries to follow the renewals and developments in ICT and reflect to the service process in order not to be alienated from the society in which they give service. Thus, the public libraries must develop a *powerful budget policy*.
15. The legal regulations must be organized and supported to develop the *sponsorship system* in both countries' public libraries.
16. The librarians and library managers in the public libraries in Turkey must be supported to have *master degrees*. It must not be forgotton that the master education that the library staff will take enforces the intellectual quality of the libraries.
17. The *lifelong learning activities* such as education seminars, symposiums and workshops for the librarians and library managers who are the most important human sources of the public libraries are very important in terms of their professional developments. The increase in this kind of activities in Turkey and Bulgaria will make the public libraries more powerful in terms of the human sources.
18. The public libraries in Turkey and Bulgaria must utmost benefit from the information technologies, internet and social media applications while carrying out *Public Relations activities*.

19. The *public libraries' service policies, lifelong learning and literacy level*, governance in both countries must be reformed in the framework of the concepts and processes particular for the information society.
20. The studies on the *cooperation, standardization and source sharing in both countries' public libraries* must be increased and the current studies must be supported with the information and communication technologies.
21. The public libraries in Turkey and Bulgaria are governed by the regulations. It is necessary to make legal and administrative regulations by taking into consideration the developments in the public library service in both countries and a *Public Library Law must be adapted*. In this process, the efficient attendances of the professional associations and other stakeholders in Turkey and Bulgaria are very important.
22. The public libraries in Turkey and Bulgaria must be ready for the changes that have occured or will be occured in social, cultural and educational life depending on the changes on the technology and information society. These libraries must enable to come up with *new policies* based on the current changes.

6. Conclusion

The public libraries in Turkey and Bulgaria must be organized according to the conditions of information society and be integrated to these change and revolution in order to accommodate themselves the rapid change and revolution occurred in both their region and throughout the world. The public libraries in both countries must reconsider and redefine both their service policies and main elements in accordance with the conditions of the information society. It is inevitable to have several functional and structural changes in the public libraries in Turkey and Bulgaria in terms of new approaches such as literacy level, lifelong learning, digitization and open access.

References

[1] Altay, A. (2015), "Osmanlı Döneminde Bulgaristan'da Kütüphaneler", Yeni Türkiye Balkanlar Özel Sayısı, Issue 67, pp. 2423-2428.

[2] Bulgarian Law of Public Libraries (2009), State Gazette, 42, 5 June 2009, available at: http://www-128.ibm.com/developerworks/library/ws-wsrp/ (accessed 10 March 2015).

[3] Bulgarian Libraries: Access Points to Information and Communication For All. (2014), available at:

http://www.glbulgaria.bg/upload/docs/Country_Grant_Proposal_BULGARIA_PUBLIC_EN.pdf (accessed 10 April 2016).

[4] Denchev, S., Peteva, I. and Pavlovska, E. (2006). "Libraries and Public Access to Information", in The Added Value of Public Libraries in the World of Information, IFLA Conference, 24-29 September 2006, Paris, pp. 9.

[5] Doncheva, A. et. al. (2014), Fundamental Librarianship: Library Management: Textbook, Bulgarian Library and Information Association, Sofia.

[6] FaydaligÜl, Ö. and Yılmaz, B. (2012), "Türkiye'de Halk Kütüphanelerinin Yerel Yönetimlere Devri: Kütüphaneciler Ne Düşünüyor?", in 2. Halk Kütüphaneciliği Sempozyumu: Değişen Dünyada Halk Kütüphaneleri 09-12 Mayıs 2012, Muğla inside, Kültür ve Turizm Bakanlığı, Ankara, pp. 96-119.

[7] Karadeniz, Ş. (2012), "Halk Kütüphaneleri Yönetmeliği (2012) ile Yürürlükten Kaldırılan Yönetmeliklerin Karşılaştırılması", in 2. Halk Kütüphaneciliği Sempozyumu: Değişen Dünyada Halk Kütüphaneleri 09-12 Mayıs 2012, Muğla inside, Kültür ve Turizm Bakanlığı, Ankara, pp. 85-95.

[8] KeseroĞlu, H. S. (2004), "Türkiye'de Siyasal İşleyişin Halk Kütüphanelerine Etkisi Üzerine Bir Deneme", Türk Kütüphaneciliği, Vol. 18, Issue 3, pp. 301-309.

[9] KYGM, available at: www.kygm.gov.tr (accessed 12 November 2015).

[10] Todorova, T. et. al. (2016), "Digital Preservation Policies in Bulgaria and Turkey", in Uluslararası Kültürel Mirasın ve Kültürel Bellek Kurumlarının Yönetimi Kongresi: Bildiriler = International Congress on Management of Cultural Heritage and Cultural Memory Institutions : Proceedings / Uluslararası Kültürel Mirasın ve Kültürel Bellek Kurumlarının Yönetimi Kongresi, 17-20 Eylül 2014, Osmanlı Arşivi Daire Başkanlığı, Kağıthane, İstanbul, Türkiye, Üniversite ve Araştırma Kütüphanecileri Derneği, Ankara, pp. 175-182.

[11] Yankova, I. (2004). The Modern Library: The University Library in Contemporary Education, St. Kliment Ohridski University Press, Sofia.

[12] Yilmaz, B. (1996), Halk kütüphanesi kullanımı:Sosyo-ekonomik bir çözümleme, Türk Kütüphaneciler Derneği İstanbul Şubesi, İstanbul.

[13] Yilmaz, B. (2005), "Türkiye'de kamu yönetiminin yeniden yapılandırılması süreci ve halk kütüphaneleri", Türk Kütüphaneciliği, Vol. 19, Issue 1, pp. 56-77.

[14] Yilmaz, B. (2010), "Public Libraries in Turkey", Fontees Artis Muscae, Issue 57, pp. 303-308.

The Sacred Spaces in Bulgarian Part of Strandja Mountain – an Interactive Multimedia Product

Oleg Konstantinov[1], Valeria Fol[2]
University of Library Studies and Information Technologies
Sofia, Bulgaria
[1]o.konstantinov@unibit.bg, [2]valeriafol@gmail.com

Abstract
The traditional culture of the people living in the area of Strandja Mountain preserves the idea of sacred spaces in the mountain. There, through a ritual separation of sacred spaces, the harmony between socium and nature is achieved and a tribute to renowned patron saints is paid. The ritual which banishes the dark forces, prepares the space for cult confession and in the same time is a cult action. The tradition of organizing sacred toposes of faith is kept by the Greek population, under interstate agreements moved from Bulgarian Strandzha region of Drama and Serres in northern Greece. Bulgarian population, which migrates from Turkish Strandja in Bulgaria also kept this tradition and not only recognize as their own sacred places of indigenous peoples, but also creates new ones. The product is focused on churches and shrines presentation. This multimedia product is in practice an interactive map of Strandja mountain representing individual settlements and their sacred places.
Keywords: multimedia content, multimedia application, interactive presentation, e-learning, cultural heritage, Strandja Mountain, churches, shrines, sacred

1. Introduction

The theme of the application of new information and communication technologies (ICT) in cultural heritage education is important and relevant not only for the educational institutions that teach cultural and historical heritage – cultural and historical sites and the digital representation are widely used in various public spheres. This report focuses on interactive multimedia product specifically created for the purpose of teaching different subjects in University of Library Studies and Information Technologies associated with cultural heritage, namely "The Sacred Spaces in Strandja Mountain". Based on the work of several multimedia products and their implementation in specialties related to cultural heritage has been developed a formal model for the presentation of objects and artifacts from the field of cultural and historical heritage presented at the end of this report.

2. The Project

The multimedia product "The Sacred Spaces in Strandja Mountain" is part of the activities and results from the research project "Cultures memory heritages in the region of the southern Bulgarian border". The project is managed by the Institute of Ethnology and Folklore Studies with Ethnographic Museum – BAS and supported by Fund Science researches at the Ministry of Education and Science of the Republic of Bulgaria. University of Library Studies and Information Technologies (UNIBIT) also participated in the project and multimedia product " The Sacred Spaces in Strandja Mountain" is the result of that participation.

3. Multimedia product – structure

In the multimedia product "The Sacred Spaces in Strandja Mountain" the approach is based on geopositioning specific places in Bulgarian part of Strandja Mountain and in particular sacred toposes, usually less known to the general public, but at the same time objects included in a number of educational courses related to cultural heritage. Here, the main menu is in the form of a map of Strandja, each topos is a button (hyperlink), leading to an internal page dedicated to its proper place (Fig. 1).

Separately is given access to a *Glossary* of specific words and phrases used in the area of the bulgarian part of Strandja Mountain; *References*; general informative text dedicated to the sacred space in Strandja; links to the websites of project partners and funding organization and a list of people who contributed to the realization of the product (*Acknowledgement*s). The information in the Glossary is based on the book "Forgotten saint" by prof. Valeria Fol [1]. At an inner level the interface includes links to individual ritual locations and GPS data. Each topos of faith is presented with text, pictures and video and again includes GPS data. To develop the product are used programming languages ActionScript and Lua. The product is distributed among the students through the learning management system Moodle as a separate exe-file for download.

The multimedia educational product is suitable auxiliary teaching tool for teaching ethnology, anthropology, human society and nature, faith and religion in the border areas and cultural heritage in Strandja region as well. It is also appropriate media and informative tool for visitors to museums and museum exhibitions devoted to the Bulgarian part of Strandja Mountain [2].

Fig. 1

4. Content Product

The multimedia product includes 34 major toposes available in the main menu. The inner level provides access to a further 55 objects. Most objects are presented in Malko Tarnovo – 8; with 6 sites are presented villages of Bulgari and Slivarovo; with 5 – Zabernovo, Kosti and Gramatikovo; with 4 – Stoilovo and Brushlian; with 3 – Brodilovo, Kondolovo; with 2 sites – Tsarevo, Evrenozovo and Zvezdets. With an object are presented towns Ahtopol, Primorsko and Kiten and villages Indzhe voivode, Rezovo, Varvara, Yasna Polyana, Novo Panicharevo, Fazanovo, Pismenovo, Velika, Biala voda, Kalovo, Izgrev, Krushevets, Lozenets, Sinemorets, Vizitsa. Most of these sites are settlements. Exceptions are only Thracian sanctuary Beglik Tash, the Goliamata ayazma /Vlahov dol/ and Gradishte, which are presented as separate items with a special character.

The presented objects do not exhaust all sacred sites in the Bulgarian part of Strandja mountain – the product has to be developed and complemented as well. At this point we can say that we included most of the popular sacred toposes, as well as some of the forgotten ones. Many chapels and shrines today are hard-detectable even from the few remaining elderly local people in Strandja mountain. In some cases there is only knowledge for toposes from the past, but no information about their precise location. Such sites are most commonly have long been destroyed by the time and the "buried" in a large vegetation.

The multimedia product includes a total of 40 original new videos and one archive video (for fire-games in Novo Panicharevo village), more than 1,500 photos (most of them shot by authors of the project) and about 80 texts in the form of annotations to objects.

5. Formal model to represent objects of cultural and historical heritage

In the following is described a formal model to represent objects of cultural and historical heritage based on the experience of the work on several multimedia educational products, including "The Sacred Spaces in Strandja Mountain".

Today interactivity is a leading feature in any kind applications, either separate multimedia products, websites, smartphone apps, information screens in museums and other public spaces. This modality to communication and content management on the part of the student or the average user interested in cultural and historical heritage requires more careful attitude to the creation of the product structure through which represent an area or topic related to this type of heritage. Depending on the scope of the presented topic, the structure may be more general, more internal levels or more specific – with one or two internal levels. Experience teaches us that we should be approached cautiously to multi-layering, because of the risk of confusion for the user – usually one or two internal levels are enough.

Part of the process of creating the structure is the design of main menu. It may not match the splash screen of the product, but our recommendation is to not greater spillover in introductory screens and visual effects – most often the user wants to retrieve the essence quickly, i.e. if the title screen coincides with the main menu of the application, this is not the wrong move at all.

Another important component in the presentation of cultural and historical heritage is undoubtedly the pictures. Often are used amateur photos taken spontaneously, not infrequently and with unclear copyright. Our advice here is to approach the most professional looking quality images from the composition technique of shooting light, etc. The pictures are presented usually at all levels of product creation – a separate gallery, as a visual design elements on the screens, as well in the overall design itself. The resolution of the images is not their most important characteristic in this case – often even having to reduce the size of used pictures. The resolution of the product itself is very important – pictures does not make sense to exceed it. This provides practicality in the final product size.

The same goes for the videos – they do not need to exceed a resolution size of product. If the product is intended to be viewed on large screens (e.g. in museums or galleries), then, of course, must be made to maximize resolution. Video and audio are very suitable media upon presentation of intangible movable cultural heritage, for example folk songs and dances, ceremonies and rituals.

Animation and particularly 3D visualizations are also a very suitable technique in the presentation of cultural and historical heritage. Three-dimensional objects are an ideal tool to generate so-called. "Augmented reality". As an example in this regard we can mention the outcome of a multimedia application dedicated to the Thracian treasure, discovered near the town Letnitsa [3] – by two-dimensional images of different parts of the treasure imposed on the three-dimensional figure of a horse, the treasure is presented in alleged its original purpose, namely as a harness horse (Fig. 2).

Fig. 2

In tangible heritage GPS data are extremely suitable element, if we look at less popular sites. Our work in the multimedia product "The Sacred Spaces in Strandja Mountain" provokes us to include GPS data for the sites mostly because of the difficulty in finding many of them. Most often the orientation is based on stories of local people and extremely scarce tourist guides.

Another helpful element when it comes to intangible heritage especially, is dictionary. It is extremely suitable for work with special rites, local folklore, etc. The dictionary could include typical phrases and concepts, names of toposes also, and scientific terms as well. If the dictionary is more capacious, it is appropriate to consider integrating search engine in it.

6. Conclusion

This report was dedicated to educational multimedia product "The Sacred Spaces in Strandja Mountain", developed for the purpose of training in cultural and historical heritage in SULSIT. The structure and content of the product in main lines has been described and on this basis was created formal model to represent objects in the field of cultural and historical heritage. The aim of the authors is created multimedia product to serve as a model for the implementation of ICT in teaching subjects related to cultural heritage. The formal model of representation of objects of cultural and historical heritage is suitable for integration both in education and in the digital display of artifacts in general.

References

[1] Фол, В., (1996), Забравената светица. Университетско издателство „Св. Кл. Охридски", С.

[2] Константинов, О., В. Фол (2015). Мултимедийни образователни продукти в обучението по дисциплини, свързани с културно-историческо наследство в УниБИТ. В: III Научна конференция с международно участие „Съвременни технологии в културно-историческото наследство" (сборник с доклади), София, 22-24 октомври 2015 г.

[3] Konstantinov, O., E. Kovatcheva, V. Fol, R. Nikolov, (2012), Discover the Thracians – An Approach for Use of 2D and 3D Technologies for Digitization of Cultural Heritage in the Field of E-learning, In: Proceedings of The International Conference on Digital Presentation and Preservation of Cultural and Scientific Heritage – DiPP2012, Veliko Tarnovo.

Comparative analysis of the dominant leadership styles and personality traits in Technology Advanced Quality Learning in Bulgarian

Mayiana Mitevska-Encheva
Universitu ofLibrary Studies and Information Technologies
Sofia, Bulgaria
majana@abv.bg

Abstract

Another reason to look for a correlation between leadership styles and personality traits in Technology Advanced Quality Learning is the personal success and complete self-expression. Empirical data show that good mental functioning depends on the applied leadership styles. A comparative analysis in the academic environment of the dominating leadership styles has been made as well as their interrelations with the types of personality traits. The types of leadership styles in a Bulgarian university have been analyzed. The constructs allow to be adequately measured and instruments, psychometrically and quantitatively consistent to be used. The survey results display factors for the dominant leadership styles in the specific university circles. The survey was conducted in the period October 2015 - March 2016 among 717 respondents in four Bulgarian universities. The used methodology is Multifactor Leadership Questionnaire [Bass & Avolio, 2004] and BIG Five model: Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism or Emotional stability [Costa amp; McCrae, 1994]. Conclusions have been drawn about the significant differences in the selection of the dominant leadership styles in Technology Advanced Quality Learning. Data have been processed by means of software SPSS-21.

Keywords:

leadership styles, Technology Advanced Quality Learning

Introduction

Leadership style and personality traits are closely related to the joint activity within the organization and directly influence the performance of the official functions and duties, the Technology Advanced Quality Learning, respectively. Leaders possess certain qualities that distinguish them from the others such as: the level of intelligence, the activity, the charismatic appearance, the sense of initiative, the self-confidence, although largely dependent on the situation (Stogdill, R., 1974). A number of authors, including with studies at students show that charismatic leaders compared to other leaders, tend to achieve greater success both for themselves and their ideas, and the structures they work for and not less - for their followers (Avolio, 1999).

The main idea of the "New paradigm" is that leaders are seen as "managing the meaning," not only as influencing their subordinates in dynamic situations (Bryman, 1996). In the current study is used one of the most popular models of "the New paradigm," developed by B. Bass (Bass, 1998) to measure the leadership behavior. The emphasis is put on the interpersonal

transactions of leaders and followers, as well as on the personality of the leader. This justifies the use of the questionnaire for the personality traits – the Big Five.

Methodology

The Multifactor Leadership Questionnaire of B. B. Bass and B. Avolio. The tool shows high validity (α = 0.74). The internal consistency of the Multifactor Leadership Questionnaire is also very good - α = 0.70 for all scales (Bass & Avolio, 2004). The Multifactor leadership questionnaire (MLQ) defines four types of components: (1) idealized influence with allegations, such as: "People are proud to be associated with me", the transformational leaders behave in a way that leads to admiration, trust and respect to them; their followers want to emulate them, (2) inspirational motivation, "He offers interesting ideas about what we can do". The leader encourages and inspires people with enthusiasm and optimism about the vision for future development, (3) intellectual stimulation: "I urge people to rethink ideas that they never before questioned". The transformational leaders encourage their followers to express doubt in the assumptions, to rethink issues and approaches to old solutions, to seek new ways, to be creative and innovative, and (4) individual consideration (respect) or individualized attention: "I pay particular attention to people who seem rejected". The leader actively develops the potential of their employees by creating new opportunities for development and mediation and pay attention to all the needs and desires of the followers.

The Questionnaire to study the personality traits was created by Donnellan and colleagues (The Mini-IPIP - International Personality Item Pool), it contains twenty items with the five – point rating scale of Likert (Donnellan, Oswald, Baird, Lucas, 2006), based on the so called "Five-factor model of personality". The questionnaire was used in the Bulgarian socio- cultural environment and confirms the five-factor structure and the high internal consistency of each of the scales (Karabeliova at all, 2012). This instrument measures the traits of the personality and it was found that when used in different socio-cultural context it shows a high internal consistency, which allows the assessment of the five basic personality dimensions:

- Emotional stability - neuroticism, as the content of the factor "neuroticism" is not limited to the susceptibility to emotional distress, people with low levels of "neuroticism" are emotionally stable.
- Extroversion - those with high scores on it are well-intentioned towards the others, feel better among large groups of people, and love to visit crowded gatherings (by Costa, McCrae and Holland, 1984).
- Openness to new experience – intellectually curious to both the outside and their inner world and their lives are rich in new experiences, willingly embracing new ideas and untraditional values and draw experience from both the positive and the negative experiences. The reticence to new

experience does not include implicitly hostile intolerance and authoritarian aggression.

- Agreeableness towards the others, cooperation - dimension related to the interpersonal relationships; the individual open to the others is basically altruistic and willing to be compassionate and empathize with the others.
- Conscientiousness – goal-oriented – strong-willed and consistent, Digman and Takemoto- Chock (Digman & Takemoto-Chock, 1981) call this domain "Striving for Excellence".

In this study the leadership styles and the personality traits are accepted to be variables as they allow to be adequately measured. In this way can be applied both quantitative research methods and measurement tools, psychometrically relevant.

The displayed variables make it possible to formulate the main goal of the study - to outline the main characteristics of the leadership style and the personality traits and make a comparative analysis according to the used management styles in the different universities. Charismatic leaders emphasize the "symbolic leadership behavior", the dream and inspiring message, the intellectual stimulation of the followers through the leadership ability to show confidence in themselves and their followers, the sacrifice and implementation "beyond the honor" of the followers [6,7]. This gives reason to believe that personality traits are mainly related to extraversion and cooperation. Probably an important trait for the liberal leadership is the openness. The analysis and evaluation of the survey results will enable to draw the necessary conclusions, to reveal trends in the development and the possibility of change in the Technology Advanced Quality Learning.

Distribution of the surveyed persons: The study was conducted during the period 2014 - 2015 on a sample of 717 people divided into groups, depending on the studied demographics. Women - 43.10%; men - 56.9%. Depending on the position held in the organization 30.0% were managers, and 70.0% -subordinates. According to the age they are divided into the following groups: up to the age of 25 years - 31.6 percent, from 26 to 35 - 21.7%; from 36 to 45 - 20.0% and over 45 - 26.7%. According to the total period of service: up to 5 years -31.6%, up to 15 years - 31.7%; over 15 years - 36.7%. 28.6% are holders of bachelor degree, 25.4% are masters and 44.4% are employees with secondary education. For the various universities the percentage of the respondents is distributed fairly evenly: for the universities in the capital town - 55.1%, for the universities in the country - 44.9 %.

Discussion of results

The significant influence of the personality traits and the leadership styles are shown in Table 1. The regression analysis displays successively the estimated

coefficients by the method of maximum approximation, the standardized regression coefficients after removal of insignificant effects, the degree of importance and the refined coefficients of explained variation. Beta (β) is the parameter of the linear equation and is called the regression coefficient. As several dependent variables are used, as an additional factor is introduced ΔR2 - Adjusted R Square. It shows the percentage of the explained variance.

Tab. 1. *Influence of the personality traits on the leadership styles*

Personality traits	**Leadership styles**			
	R^2	**B**	**T**	**p**
	Idealized influence			
Agreeableness	49	.23	6.20	.000
Neuroticism		.17	4.01	.000
	Inspirational motivation			
Conscientiousness	.45	.24	6.84	.000
Neuroticism		-.21	-5.42	.000
	Intellectual stimulation			
Extraversion	.42	.09	2.11	.035
Agreeableness		.15	3.91	.000
Conscientiousness		.10	2.19	.029
Neuroticism		-.16	-3.65	.000
	Individualized consideration			
Agreeableness	.50	.23	6.01	.000
Conscientiousness		.11	2.34	.019
Neuroticism		-.26	-6.10	.000
	Contingent reward			
Extraversion	.45	-.09	-2.14	.033
Agreeableness		.18	4.65	.000
Conscientiousness		.10	2.11	.035
Neuroticism		-.27	-6.19	.000
	Management –by-Exception			
Extraversion	.28	.08	2.37	.018
Agreeableness		.12	3.63	.000
	Liberal leadership (Free-rein)			
Extraversion	.41	.10	2.51	.012
Agreeableness		.24	6.56	.000
Openness		-.13	-2.40	.017

Significant influence of the personality traits on each of the studied leadership styles was established. It can be argued that the result is logical as the personality traits are relatively independent dispositions. The strongest effect has the agreeableness on the charismatic style, followed by the conscientiousness and the extraversion. Another personality trait from the model of the "Big Five", which has a direct effect on job satisfaction, is the

neuroticism. The influence of the neuroticism on the leadership styles is negative and significant and determines the dimensions of charismatic and transformational leadership. Liberal leadership is influenced by personality traits such as agreeableness, extroversion and openness.

It can be considered from the data presented that leaders seek to raise the awareness of their followers about what is good for the whole group by implementing proactive measures in the Technology Advanced Quality Learning. The refined coefficient of explained variance is $\Delta R2 = 0,49$, which means that personality traits such as agreeableness and emotional stability explain 49% of the variance. This percentage is the highest in the influence of agreeableness and conscientiousness on the attention of the leader to his followers - 50%. Leaders pay special attention to the needs of every follower, to their expectations and desire for development. It could be argued that the leader gives many opportunities to the followers to learn new things, he discusses individual ideas and plans for personal growth. A supportive and stimulating intragroup climate is being created. The inspirational motivation and the intellectual stimulation in turn are influenced by the conscientiousness and the agreeableness, but the extraversion and the emotional stability are also important. The refined coefficient of explained variance is $\Delta R2 = 0,45$ and $\Delta R2 = 0,42$, respectively. The extraversion and the agreeableness are the leading traits of the way the manager can successfully cope with the problems, but such influence is explained by 28% of people's behavior. It is expected from the leader to do his best, to observe and monitor possible deviations of their subordinates of the set standards, errors and inaccuracies that are allowed and take corrective actions when necessary. Liberal leadership is influenced by the extraversion and the agreeableness and negatively by the openness. Thus, the leader exhibits self-control considered as an active process of planning and organizing activities, and the implementation of goals and objectives. But he also follows to a larger extent the tested working ways.

Conclusions

The personality trait of agreeableness has the most positive effects on the leadership styles in the surveyed universities, followed by the emotional stability and the extraversion, mainly on the charismatic style of leadership. In this sense it can be said that the assumption of the influence of the "Big Five" on the leadership styles in Technology Advanced Quality Learning is being confirmed. The exception is the purposefulness. Personality traits such as extroversion, agreeableness, neuroticism and openness are integrated into the behavior of the leader. The main advantage for the Technology Advanced Quality Learning in this case is that the leaders are focused on building the interpersonal relationships. This means that the attitude of the leaders is basic, altruistic and prone to sympathy and empathy. In their good attitude towards the others the

leaders expect the same. In this case rather the cooperation is sought. Followers themselves are motivated to perform tasks beyond their own expectations. Leaders succeed to excite and inspire their followers so that they emotionally identify with the ideas of the leader. The idealized influence occurs when leaders are in the role of models to follow by their followers and is regarded as an important emotional component of the leadership. These leaders possess personality traits that are associated with agreeableness, emotional stability and conscientiousness.

References

[1] Ригио, Роналд, (2006), Въведение в индустиалната/организационната психология. София, Дилок, 550 с. ISBN – 10: 954-9994-43-0

[2] Alimo-Metcalfe, B., Alban-Metcalfe, R. (2002). Leadership. - In: P., Warr, (Ed.). Psychology at Work. London: Penguin Books, pp. 300-326.

[3] Avolio, B., Bass, B., Jung, D. (1999). Re-examining the components of transformational and transactional leadership using the Multifactor Leadership Questionnaire. Journal of Occupational and Organizational Psychology, 72, pp. 441-462.

[4] Bass, B. Avolio, B. (1993). Transformational Leadership: A Response to critiques. - In: P. Warr, (Ed.) Psychology at Work. London: Penguin Books, pp. 300-326.

[5] Bass, B. (February, 1997). Does the Transactional-Transformational Leadership Paradigm Transcend Organizational and National Boundaries? American Psychologist, pp. 130-139.

[6] Bass, B. (1998). Transformational Leadership: Industrial, Military, and Educational Impact. Mahwah, New Jersey: Erlbaum.

[7] Bass, B. M., (1981), Stodgill'shandbookofleadership:Asurveyoftheoryandresearch. New York: Free Press.

[8] Bass, B. M., (1990), BassandStogdill'shandbookofleadership:Theory,researchand managerial applications. New York: Free Press. вж. http://www.francisflynn.com/papers/Benjamin_Flynn_2006.pdf

[9] Bryman, A. (1996). Leadership in Organizations. - In: S. R. Clegg, C. Handy and W. R. Nord (Eds.), Handbook of Organizational Studies, pp. London: Sage, pp. 276-292.

[10] Donnellan, M., Oswald, F., Baird, B., Lucas, R. (2006). The Mini-IPIP Scales: Tiny-Yet-Effective Measures of the Big Five Factors of Personality. Psychological Assessment, 18(2), 192–203.

[11] Karabeliova, S., Petrov, D., Milanov, M., Ivanova, E. (2012). Personality traits and risky health behavior. Annual Journal of Psychology, Sofia University (in press).

*[12] McCrae, R. R & John, O. (1992). An introduction to the five-factor model and its applications. Journal of Personality, **60**(2), 174-214.*

[13] Stogdill, Ralph M., (1974), Handbook of leadership: A survey of theory and research. New York, NY, US: Free Press. viii 613 pp.

http://psycnet.apa.org/psycinfo/1974-22876-000.
http://www.hdc.lsuhsc.edu/hdcit/2012_2013Seminars/LeadershipPresentation9712.pdf

Teaching robotics at the pedagogical higher educational establishment: Kazakhstan experience

[1]Nurbekova Zhanat, [2]Mukhamediyeva Kymbatsha, [3]Assainova Almagul, [4]Nurgazinova Gulbarshyn, [5]Kusmanov Kuat

[1, 2, 4] L.N. Gumilyov Eurasian National University, Astana, Kazakhstan
[3, 5]Pavlodar State Pedagogical Institute, Pavlodar, Kazakhstan
[1]zhanat_n@mail.ru, [2]kymbatsha@mail.ru, [3]asal_fr@mail.ru,
[4]nurgasinova@mail.ru, [5]kuat-75@mail.ru

Abstract

In the terms of digital community the foundation of such innovative technologies like info-communicational and robotics are developing and implementing in our society and they are the basic transformations of the educational system.

The development of highly-technological fields in the industry of Kazakhstan has influenced the educational development strategies. This process orientates the system of school education on the knowledge integration and the increase of STEM-education. Thus, the conditions for educational robotics at schools have determined. However, in spite of it, the robotics as a training course is not studied at pedagogical higher educational establishment and future teachers in the STEM-fields are not ready to teach robotics at schools.

This research has investigated two aspects of robotics implementation as a training course. The first, the most urgent thing is the usage of robotics as the means of teaching and integrating interdisciplinary knowledge as Physics, Maths, ICT at pedagogical higher educational establishment. Here we should notice the competence for students studying physics and maths. The majority of researchers and teachers come to the conclusion that it is very important to comprise Science, Technology, Engineering, and Math in the education of would-be-teachers could provide strong motivation, the significant improvement in the education speed, strengthening knowledge of subjects and widening professional competencies. This research introduces a new program which has already been implemented at Kazakhstan pedagogical higher educational establishment (Pavlodar city) in the educational process of future teachers of Physics. Robotics has been prepared and implemented in the educational program as an elective course. The results have shown that the course has influenced the integration of physical knowledge while robots instantiation, special integrated knowledge while working out mechanical transmission, modeling walking robots, object recognition, area orientation, temperature sensors use. Students have also improved the skills of mutual work on robotics projects, collaboration methods and work.

The second aspect for robotics studying means the formation of students' knowledge in the field of robotics usage, as an effective pedagogical technology that makes students multipurpose teachers in STEM-education. The innovation approach in studying can be defined in the following: we have arranged lessons on robotics in the chain "students-pupils-primary schoolchildren", which have had positive results in the students' development as future teachers who are not only aware of the robotics as a subject but know how to implement the techniques as a teaching

means. It is necessary to put into consideration the fact that the special research aimed at development of robotics educational system in the terms of higher educational establishments and schools has not been conducted yet.
Key words: educational robotics, pedagogical higher educational establishment, Kazakhstan, innovative program.

1 Introduction

In the terms of digital community the foundation of such innovative technologies like info-communicational and robotics are developing and implementing in our society and they are the basic transformations of the educational system. Hilbert M. (Hilbert M. 2015) states that digital community is changing education organically with the introduction of informational commuter technology (further, ICT). So, UNESCO has arranged the complex work for ICT introduction in education the result of such introductions proves the effectiveness of such technologies for education (UNESCO, 2016). For the last two decades the educational robotics especially device platforms of educational robots (Lego Mindstorm 2016), has been developed a lot in the world (Bredenfeld A et al. 2010, Pisciotta. M., et al. 2010, Strawhacker A., Bers M. 2015).

The development of highly-technological fields in the industry of Kazakhstan has influenced the educational development strategies. This process orientates the system of school education on the knowledge integration and the increase of STEM-education. Thus, the conditions for educational robotics at schools have determined. However, in spite of it, the robotics as a training course is not studied at pedagogical higher educational establishment and future teachers in the STEM-fields are not ready to teach robotics at schools.

The problem of STEM-education at schools and higher educational establishments (further HEE) nowadays is one of the most debatable theme in the system of educational development (Han S.et al 2015, Jayarajah K., et al 2014, Jeong S. & Kim H. 2015). Researchers and teachers come to the conclusion that it is very important to comprise Science, Technology, Engineering, and Math in the education of would-be-teachers could provide strong motivation, the significant improvement in the education speed, strengthening knowledge of subjects and widening professional competencies (Zawieska K., 2010, Wyffels F., 2010, Pérula-Martínez R., 2015, Petre M., 2004, Alfieri L., 2015).

Consideration of teachers training terms to their future work in the field of educational robotics has been studied by a few researchers only. D. Alimisis's works challenged specially among others (Alimisis D., 2012), Pina A. (Pina A., 2008).

Any Kazakhstan HEE trains would-be teachers who are professionally aware of in two aspects: specific subject knowledge and methodology of teaching such a subject at school. Any future teacher should know such competences perfectly in spite of the fact that these competencies are be to intercorrelated but

different in their meaning. On the one hand, educational robotics is the means of intensification and integration of knowledge by each student of Physics and Mathematics. On the other hand, educational robotics is a type of pedagogical technology which can be used by the same students in their future workplaces at school teaching robotics and other subjects in the STEM-category (Physics, Computer Science, Mathematics).

The issue of methodology of teaching robotics is closely connected with the theoretical basis which is based on robotics didactics as the constructionism theory. The latter is focused on the knowledge construction on the base of students' experience about the real world (Papert S., 1991). Educational terms based on the constructions contributes interrelation students with the knowledge and each other with the help of various tools and focuses on the education as the process (Hye-Gyoung Yoon&Byoung Sug Kim 2016). That's why constructionism nature should be put into consideration in the methodology of teaching robotics at school. This research is designed to study innovation approach in the studying of robotics at Kazakhstan pedagogical higher educational establishment (Pavlodar city) in the educational process of future teachers of Physics.

The article is arranged in the following way: Section 2 describes aims and expected results from robotics in HEE implementation, Section 3 describes tools used and time for research conduction, the results are shown in section 4, then some conclusions are drawn and further research development are done in Section 5.

2 Aims And Expected Results From Robotics In Hee Implementation

2.1. Educational Robotics As The Means Of Study And Integration Of Inter Subject Knowledge For The Future Teachers Of Physics And Mathematics

Introduction of a course of robotics into the educational program for teachers of Physics and Mathematics in pedagogical HEE is connected with the issues of determination of its introduction aim and its place in the educational program. Tyler R.W. (1949) and Adam (2004) pinpoint that teacher's training content does not consist of the number of subjects independent from each other but the educational programme is compiled as a complex aimed program which is focused on the final results. It defines transforming peculiarities of the educational program (Barnett & Coate 2005, Coate 2009).

The content of such structural unit (modules, subjects, topics, notions) should be taken into consideration as an organic part of the whole content in order to learn competencies (Adam 2004, Mäkinen&Annala 2010). In the terms of a pedagogical HEE any content unit including into the educational program should

develop professional competencies for a future teacher. These competencies should be bound to a subject itself and methodology of its teaching as well.

Introducing the robotics course we have analysed the way of direction of subject content to the development of professional competence, i.e. competences in the knowledge of the subject. Selecting the course content we have hung upon the research in the field of robotics training content (Pina, et al 2008, Alimisis D., 2009, Ucgul, 2012, L. Alfieri, et al, 2015) and the basic textbooks on robotics.

The teaching aid by Ceceri K. (Ceceri 2012) is directed to the improvement of abilities in task solution in the difficult situations while project work-out is hand-made robots made of available materials. The teaching aid by The Lego®Mindstorms® Ev3 Discovery Book by the author Valk L. (Valk 2014) consists of multi-teaching parts which gives the opportunity to widen the knowledge in the field of construction and programming robots on the base of Lego device platform.

The teaching aid under the title "Robotics for children and parents" by S. Filippov (Filippov 2013) reseals the base for construction in Lego, programming in the languages NXY-G, Robolab и RobotC, and the elements of the theory of automatic management, also the book contains descriptions of advanced robots constructions and complicated tasks to navigate mazes, robots-manipulators and an inversed line. Also the book pays a great attention to the algorithms management.

Terry Griffin's textbook (Griffin 2014) focuses on the EV3 robots programming more than on their mechanical construction. All the programs in the book describe the work with one multipurpose robot or the intellectual block EV3 (Intelligent Brick EV3). The textbook trains how to work with the core parts of EV3 software, as data wires, files and variables and how these pieces can work together.

Kee's textbook (Kee 2013) represents a manual divided into parts each of them should be studied during 10 weeks. In the book the author shows the step-by-step process of robots Lego construction and EV3 programming. Concentrating on the task a teacher can choose a level and age of a pupil from 9 to 15 years old. The manual by Benedettelli D. (Benedettelli 2014) is designed for anybody who takes in robotics. The book can teach robots construction and programming using THE LEGO® MINDSTORMS® EV3 independent on the reader's age. The book contains comics and trains robots programming via experiments. The author Isogawa Y. (Isogawa 2015) completely reveals different devices of robots in the forms of mini-constructions with the help of which a reader can construct various robots parts himself.

Analysis of the mentioned-above books let us select robotics training content. The table 1 underlines the degree of content unit development of such competencies as a professional competence of the specialty "Computer Science", "Mathematics" and "Physics". Thus, we can see how much naturally a

new teaching course – robotics – introduces into the educational program for Physical-and-Mathematical specialties at pedagogical HEE.

Table 1. *The connection of robotics course and competences in the field of some specialties (at the examples of Physical-and-mathematical specialties at pedagogical HEE)*

Content lines of educational program robotics	**Professional competences**		
	Computer Science	**Mathematics**	**Physics**
Invariant part			
The main notions in robotics Timeline: The History of Robots and Robotics	●	○	⊙
The world of Robotics (the core terms in robotics and their notions)	●	○	⊙
What are the main components of a robot?	●	⊙	●
Building robotics Basic Mechanisms	●	○	●
Vehicles	⊙	⊙	●
Moving without Tires	⊙	⊙	●
Arms, Wings and other Movements	⊙	⊙	●
Sensors	⊙	⊙	●
Robots models Carriages (mono-engined, multi-engined, independent control, changeable ratio)	⊙	●	●
Robot- quad	⊙	●	●
Walking robots (four-legged pedestrian, universal walker)	⊙	●	●
Capitsa's pendulum	⊙	●	●
A Two-engined carriage (a triple-dotted scheme, a simplest carriage, a compact carriage, four-wheel drive)	⊙	●	●
The EV3 programming environment The building blocks of any program. Programming with the brick program app	●	⊙	⊙
EV3 programming EV3 software setup and overview	●	⊙	⊙
Connecting the EV3 brick to your computer	●	⊙	⊙
Importing a brick program	●	⊙	⊙
Experimenting with action blocks	●	⊙	⊙
Controlling the program flow	●	⊙	⊙
Motion / Sensors / Program flow The WallFollower program navigating a maze Data wires / Data wires and the switch block Variables / My blocks / Math and logic The EV3 lights, button and display / Arrays / Files Data logging / Multitasking A PID-controlled LineFollower program	●	●	⊙
Variable part			
Programming in RobotC	●	⊙	⊙

Introduction (Firmware, Hello, world! Program structure)			
Engine control (engine condition, built-in turns sensor, engine synchronization, mode of impulse modulation, mirror direction)	⊙	⊙	●
Sensors (engine and sensor tuning, sensor type)	⊙	⊙	●
Cancels and timers	⊙	⊙	●
Parallel tasks (task management, work with sensors in parallel tasks, parallel engine management, monitor graphics, massive, files operations)	⊙	⊙	●
Algorithms management - Relay controller	⊙	⊙	●
Proportional controller	⊙	⊙	●
Proportional-differential controller	⊙	⊙	●
Cubic component	⊙	⊙	●
Floating coefficient	⊙	⊙	●
PID-controller. RAW format	⊙	⊙	●
Elements of automatic management theory at school	●	●	●
Robot tasks - Non-feedback control	●	●	●
Feedback control	●	●	●
Kegged-ring (dancing in a circle, not to fall from a table, pull out all cans, non to do extra movements, movement on a spiral)	●	●	●
Movement along a line (one sensor, two sensors, slalom, an inversed line)	●	●	●
Movement along a room (a little inventor, defence from sticking, an extra sensor)	●	●	●
Items detour	●	●	●
Robots-drummer	●	●	●
A maze	●	●	●
A Remote control	●	●	●
Robots-manipulators	●	●	●
A six-legged robot	●	●	●
Application of robotics in the subject field on specialty	Projects on work-out module programs in order to recognize items by robots, speech development, experience. Introduction to astroinformatics science	Projects on implementation of mathematic theories and formulas in the process of robot intelligence. Introduction to astroinformatics science	Projects on robots work-out for real situations. Introduction to astroinformatics science

Designations: ○- weak expressiveness, ⊙- medial expressiveness, ●- strong expressiveness

The table analysis shows that all units of the course content of the educational program on robotics include professional competences of the specialties "Computer Science", "Mathematics", "Physics". All of them are designed to develop subject knowledge. The consideration of the expressiveness degree also lets a teacher pay student's attention to the usage of the knowledge gained and students' experience while learning. So, learning the theme "The core device for constructing robots" for future teachers of Physics a teacher can give a task for students to actualize their knowledge on devices and offer their own variants of robots ratio. Thus, students always generalize and integrate their knowledge that has a positive influence upon students' knowledge intensification in the field of specialty. Thus, introduction of the robotics course in the educational program, e.g. on the specialty "Physics" at pedagogical HEE, lets develop professional competence, i.e. competence in the field of physics.

We have also underlined in the table invariant and variant parts. The invariant one is the base part which is necessary to study the core in educational robotics. Learning the invariant part a student will be provided with the base competences in the field of robotics. This part can be added with the specific content which can widen students' knowledge in the field of robotics and deepen their professional competence. The variant part includes programming on RobotC as this programming language lets create complicated algorithms of robot's actions depending on the special conditions.

It is necessary to note that any teacher can make the designing of an elective robotics course for a particular specialty.

2.2. Educational Robotics As A Pedagogical Technology

In addition to the fact that educational robotics integrates knowledge, it can be used as a pedagogical technology which can be implemented by students further at their school workplaces while teaching robotics and a studying subject on specialty as well.

The author Ospennikova E. (Ospennikova E., et al. 2015) mentions that robotics stimulates an active learning subject and helps make the teaching process individual that develops students' ability to work in teams as it is quite difficult to create a highly-qualified computerized system taking into consideration interdisciplinary solutions. Working in teams helps create positive conditions to develop a wide range of communicative competences for students. However, it is not the last role of robotics as a pedagogical technology.

Based on the research by Alimisis and Pina (Alimisis 2012, Pina 2015) robotics didactics is based on the advanced approaches to constructionism in teaching Enhanced Constructivist Pedagogical Methods. It includes the theoretical study

through a creative activity to design and manufacture real objects, a permanent feedback, a team collaboration, a laboratory project, encouraging creative problem solving and combining interdisciplinary concepts from different knowledge areas (science, mathematics, technology, etc. Thus, to make a teaching process more effective a teacher should master these pedagogical methods.

Based on the mentioned-above facts, competence in the field of methodology of teaching robotics for the future teacher of Physical-and-Maths profile includes:

- an ability to stimulate students to their creative activity on designing and manufacturing real objects;
- an ability to make students generalize and systematize their knowledge on the base of experience gained at the robotics lessons; skills to initialize the use of deduction and induction by students, their ability to unite interdisciplinary concepts from STEM;
- an ability to arrange reflection and self-reflection of learning activity on robotics;
- an ability to represent material in the form of mind-maps, info-graphics, and skills to teach students draw information;
- readiness to teach students work in teams, manage a project and collaborate with team members effectively;
- an ability to arrange a permanent feedback with students;
- an ability to assess a project on criteria, an ability to arrange self-assessment of students' work on robotics.

Mastering competences in the field of methodology of robotics teaching let students as future teachers use educational robotics as an effective pedagogical technology at school that makes student be a universal teacher in STEM-education.

We have faced the question how it is possible to develop the competence in the field of teaching students of pedagogical HEE robotics. Methodological competence is formed not in the process of theoretical work but in the process of a complicated pedagogical activity and it should have a highly expressive practical-oriented approach. That's why we have used educational methods in collaboration for parallel formation a competence in the field of robotics teaching by students of different groups: students of secondary and primary schools.

The collaboration supposes a positive interrelation with aims and tasks coincided by various participants. In 1989, Kagan S. offered the lesson structure in accordance with the learning principles in collaboration, step-by-step manuals to the use of methods and their impact on the studying results. Johnson D.W. (1989) defined the studying groups in collaboration, methodology of work with these groups. Also in research conducted by Johnson D.W. (Johnson, et al.

2000) eight studying methods in collaboration were analysed, these methods have shown a unique significance in students' development. Teaching experience in collaboration at the sample of learning languages was described in the research done by Lucha Z.T.&Bongase T.M. (2015). We agree with the authors that the main aim in collaboration arrangement is directed to quality improvement of learning process by means of thematic projects completion in groups, arrangement of cognitive process while problem-solving mutual process, and an active students' position in knowledge gaining.

In order to teach students robotics parallel with the course studying we have used a creative collaboration in an informal group (Johnson,et al. 2000): we have organized lessons on robotics in the chain "students-pupils-infant students", which have had positive results in students' development as future teachers who can be aware of robotics as a subject and can implement robotics as a means of studying. It is necessary to note that the target research has not been done yet in the condition of adherence to the principles of continuity between a pedagogical HEE, a school and infant schools.

3 Instruments And Times

From the second term in 2015-2016 an elective course on robotics was introduced into the educational program of the specialty "Physics" on the base of the pedagogical HEE (Kazakhstan) in the frame of additional education and studying continuity on the chain "students-pupils-infant students". Also the robotics elective course was arranged on the base of Eurasian National University named after L.M. Gumilev (Kazakhstan). The HEEs have opened the robotics laboratories where students are involved into modeling robots with the use of a special device platform and software.

Also we have arranged lessons in informal groups "students-pupils-infant students" two times a week. The lessons were conducted in the form of a project with mini-groups up to 4 students. The group number at one lesson was not exceeded three pupils.

During the robotics teaching, we have used the most popular platforms of robots modeling available for children's studying from 5 years old and at the same time creating a complicated projects. The kit of LEGO MINDSTORMS Education EV3 was used as a basic one as one of the most advanced and multi-functional kits of "LEGO Education" brand. To conduct lessons on the topics "The Solar Energy", "The Wind Energy", and "Hydro energy". An extra kit "Renewable sources of energy" was taken in. For the effective arrangement of Physics lessons and visual studying of physical laws, scientific experiments conduction, analyses and data systematization have been obtained experimentally with the help of the electronic issue "Physical experiments" LME EV3. To make projects in the field of astroinformatics science we have used the kit "Space projects" LEGO MINDSTORMS Education EV3.

On the lessons of an elective course on robotics physical students have studied the basis of robots modeling, the graphic programming language Labview and the advance language RobotC.

At mutual lessons in groups, students together with infant pupils have been engaged into the project on robots construction, programming simple movements with the use of graphic language of programming Labview.

4 Preliminary Results

The research results on introduction the course of robotics in the educational program for future teachers of Physics were assessed by two criteria, in accordance with the previous sections of the article: a) competence assessment in the field of robotics (subject knowledge) and b) competence assessment in the field of methodology of robotics teaching.

As far as the main result of the robotics course is the final product – a robot, it means that the assessment could be done on the designed robots.

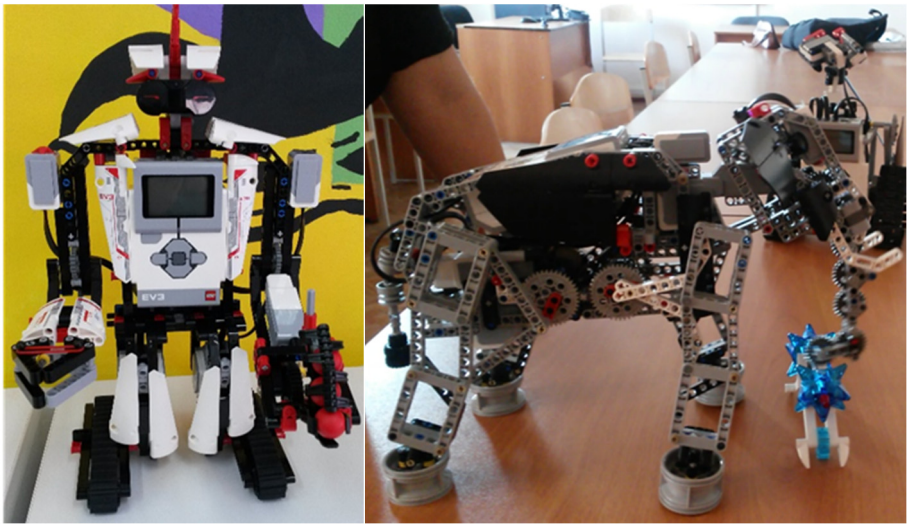
As the main criteria we have chosen the following:

- functional applicability of a robot – a sample should make basic functions appropriate to a certain robot type, e.g. if a robot is designed as a quad, we must notice if it can carry something heavy:
- integrity – an assessment of robot ability to solve real tasks in the particular conditions, e.g. a real situation with various types of cargo located chaotically is created, so a robot-quad should clean the area;
- productivity/effectiveness – an assessment of robot ability to provide the results in the frame of expected resource expenses, e.g. the speed of complete a task of cleaning the game area by a robot should be taken into consideration
- technology - an assessment of using tool opportunities of LEGO-constructor and software, their propriety, e.g. robot-quad should be constructed in such a way when students can use different ratio choice of them can influence the speed and quad power;
- design – an assessment of how a robot looks like and the degree of use of copyright.

An assessment was conducted in the process of robot competition where the objects fulfill the appropriate tasks. Such kind of assessment is usually used at the international contest on robotics and us the most objective.

The results of inner competition have shown (Table 2) that 81% of students successfully worked out the prototypes of robots with an enough functional applicability. The samples of designed robots are shown at the picture 1 (a, b).

The students faced the problems with technology: there were practically no robots with non-standard technological bounds and devices. As far as the students used a traditional device platform which didn't let them make more creative models, robots design was rather traditional.



a) *b)*

Picture 1. *Robots made by students with the usage of LEGO-components*

During the assembly process it was noticed that students used the knowledge from theoretical Physics, Mechanics, Mathematics (constructing process), Computer Science (programming process), as it was marked in the Table 1 according to the connected competences. The students' survey also shows that they have realized what kind of knowledge they need to make the appropriate device in robot.

Table 2. *Robot assessment results*

Robot assessment criteria	Levels	Number of students
Functional applicability	High	7
	Half	11
	Low	4
Integrity	High	1
	Half	12
	Low	7
Productivity/effectiveness	HIGH	3
	Half	14
	Low	5
Technology	High	0
	Half	18
	Low	4
Design	High	0
	Half	10
	Low	12

Robot working-out has carried out in a group with the help of the project method. It was noted that the students have improved their skills of collaboration with robotics projects: they have learned how to communicate

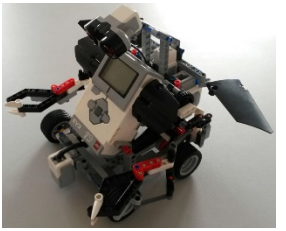
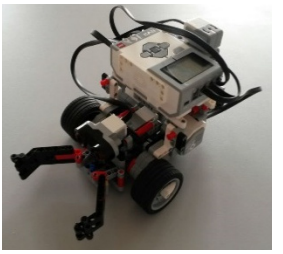
with each other, distribute and make the plan of their work (every participant was busy with his part of the common problem), how to make brain-storms, listen to all opinions, practically all participants discussed the results of their work.

We would like to illustrate a sample of the task solving which is designed to develop students' knowledge from different fields (Table 3). While making the algorithms of robot-car movement along the walls in some situations P-controller can make the system unsteady. In this case we need to consider the task for making a proportion to the differential controller.

To find out the solution the students are learning the movement direction of a robot, the influence of a speed vector on the management controller and building a mathematical model and the program for RobotC aftermath.

Table 3. *A sample of knowledge integration from different subject fields while task-solving on robotics*

Subject field of Computer Science	Subject field of Mathematics	Subject field of Physics

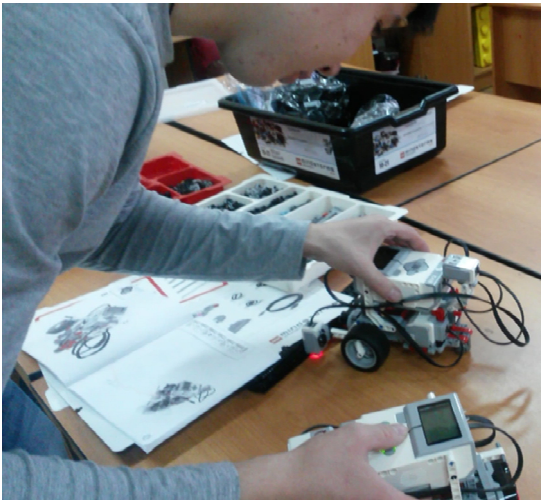
task main()
{
float u, k1=2, k2=10; int Sold, L;
Sold=L=SensorValue[S1];
while(true)
{
u= k1*(SensorValue[S1]-L)+
k2*(SensorValue[S1]-Sold);
motor[motorB]=50+u;
motor[motorC]=50-u;
Sold=SensorValue[S1];
wait1Msec(1);
}
	It is known that speed is as $v=\Delta s/\Delta t$, where Δs is a distance change for the time period Δt. We need to find out the differential component via the speed of robot deviation from the position stated:
	$ud = k*(S1 - Sold)/ \Delta t$ where $S1$ is the current distance to the wall. *Solid* is the distance at the previous step. As measurements are conducted every equal time period, then Δt can be taken as a constant unit when $k2=k*\Delta t$. $ud=k2*(Sl-Solid)$ thus, PD-controller is described with the formula from the 2 components $u=up+ud=k1*(S1-L)+k2*(S1-Sold)$.
	It is possible to prove mathematically that to make the steady achievement a coefficient $k2$ must exceed $k1$ at the terms of the different component.
		
		 

As it is shown a student integrates his knowledge from the fields of Mechanics, Mathematics, Computer Science while task-solving. Thus, the results show that the course of robotics has influenced the knowledge integration in the field of

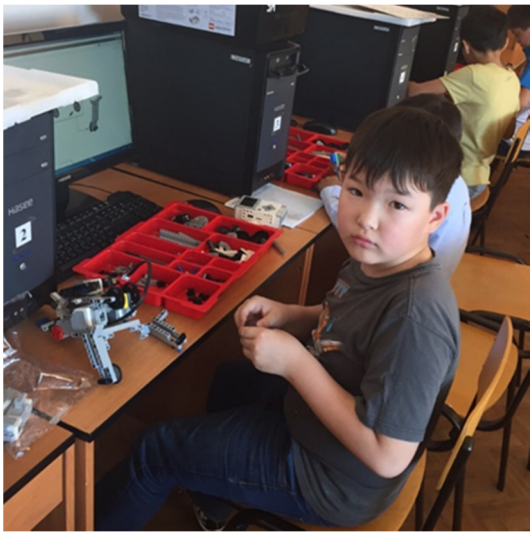
STEM by students – future teachers of Physics, and improved the skills of mutual group work.

The second observation is about the competence students' assessment in the field of methodology of teaching robotics which students suppose to gain during the lessons with informal groups "students-pupils-infant students". In the previous article sections the process of lesson arrangement was described. Mini-groups were given out the tasks to assembly a simple robot with the minimal number of parts like moving models of cars, animals, aircrafts, carriages. Groups selected the mentors whose aim was to arrange effective work on robot construction involving the participants of different ages. It is necessary to note that at the first lessons we could observe the chaos because infant students, pupils and students as well didn't understand the instructions and their aims in groups. At the following lessons work time for infants was reduced in the way that they could manage to assembly a small part of the robot for the common result.

A teacher monitors the working process in the groups and directs the students' activity as leaders of project groups paying a special attention to use active working methods like brain-storms, reflection, generalization of knowledge, mind-maps making, assessment. By the end of the projects the students have learned how to manage their mini-groups. The picture 2 illustrates a sample of project fulfillment in mini-groups. Pupils have obtained the basic knowledge in constructing robots (picture 3) and in graphic form of programming Labview (picture 4).



Picture 2. *Children are assembling a simple robot with LEGO-components at the lessons with the informal group (students-pupils-infant students)*



Picture 3. *A lesson fragment describing robot assembling*

Picture 4. *Children are making simple algorithms in Labview*

In our opinion, the work of informal groups has got a significant contribution in forming the pedagogical mastership by students which is the main competence in the field of robotics teaching. Studying in collaboration and arranging an experimental ground with children of school and pres-school ages, students have a good training not only in the knowledge of robotics. In order to achieve the targets in the stated period the students had to arrange a work group correctly with the distribution of roles between all participants according to their age and knowledge in different kinds of subject. The students recalled innovative methods and approaches studied at the lessons of Pedagogy and elective courses on robotics. They implied the knowledge and found out new ways of task solving appropriate to the results needed. In the observation

process, we also noticed that a student as a group leader was trying to challenge interest from every group member, putting the task to solve, arranging discussion and solution search. It was rather difficult at the beginning for students to listen to and consider an idea and an opinion of each participant without paying attention to his/her age but later the leaders have learned how to accept younger pupils tolerantly. The students made efforts to create a positive and friendly atmosphere in the group, which led to achieve positive results in the implementation of the stated project.

The observation over the mini-group work shows that it is very important to arrange management of the group at the mutual work on the project. The knowledge of psychology and use it by future teachers give them an opportunity to distribute roles of each group member correctly because it is necessary to learn the psychology of each child and release their skills for a short period of time. Each participant has his own personality, positive and negative traits of character. The students' task was to develop positive traits of character of each participant and use the traits during the task solving of the project, as for the negative traits of character the students tried to change them into the positive ones in order to develop hidden talents. In this case, a student takes responsibility in the group and gains credibility due to his knowledge, relation and behavior towards each participant of the group. From the psychological point of view infants always show their interest to work with senior students that challenges and motivates infants a lot, especially in gaining knowledge with the help of experiments in the field of robotics in collaboration with students.

The experience of robotics teaching at the pedagogical HEE shows the preliminary results of introducing it into the educational program for future teachers of Physics as an elective course. The course has influenced an integration of knowledge on Physics while modeling robots. It was noted that the students have improved their skills to work together on robotics projects, to use collaboration and group work.

The lesson in informal groups with students and infant students where students were in charge of everything let future teachers of Physics gain knowledge in the field of robotics and instill the skills of teaching the subject at school. Together with teaching robotics, we arranged the lessons in informal groups with students and infant students where the students were leaders and teachers. The choice of such innovative approach determines the fact that a student should master the methodology of teaching with considering constructionism principles. Working in the informal group and being a leader of a mini-group, students have learned how to model robots, manage a group, distribute duties, create a friendly atmosphere, teach the group generalize and systematize knowledge. We have gained positive results in students' development as future teachers in the terms of collaboration, and their

readiness to use the educational robotics as an effective pedagogical technology at school.

Thus, the results of research have shown that collaboration in the chain "students-pupils-infant students" let develop students as future teachers of STEM-education who are capable to teach educational robotics effectively with considering a constructivism approach in teaching robotics.

5. CONCLUSION

Because of our research, we have concluded that:

1. The main term for introduction of educational robotics at schools is a demand of the modern society in development of technological fields of industry and the orientation of school education system to the integration of knowledge and increase of the role of STEM-education.
2. Integrating form of educational robotics lets students use robotics as a pedagogical technology in their future professional activity on the base of inter-disciplinary realization.
3. The selection of studying content on the base of invariant and variant parts lets realize a constructivism approach to teaching students, which is aimed as a skill to design robot models.
4. The continuity principle in teaching can be completely realized in the terms of implementation of the innovative approach in teaching that means the organization of lessons on robotics in the chain "students – pupils – infant students" in the process of project activity of students on robotics-technological projects.
5. The necessity of a special course introduction on educational robotics is determined with two aspects: robotics implementation as a means of teaching and a pedagogical technology with the aim of stage formation and development of teachers' knowledge in order to realize STEM-education.

We can see the further development of research in expanding opportunities of educational robotics as a pedagogical technology. As robotics is nowadays has become a part of professional competence of a future teacher of STEM-education it is necessary to pay attention to the conditions of competence formation on robotics by the students of the pedagogical higher educational establishment.

References

[1] Han, S., Yalvac, B., Capraro, M.M., & Capraro, R.M. (2015), "In-service Teachers' Implementation and Understanding of STEM Project Based Learning". EURASIA Journal of Mathematics, Science and Technology Education, Vol. 11 № 1, pp. 63-76.

[2] Jayarajah, K., Saat, R.M. & Rauf, R.A. (2014), "A Review of Science, Technology, Engineering & Mathematics (STEM) Education Research from 1999–2013: A Malaysian

Perspective". EURASIA Journal of Mathematics, Science and Technology Education, Vol. 10 № 3, pp. 155-163.

[3] Jeong, S. & Kim, H. (2015), "The Effect of a Climate Change Monitoring Program on Students' Knowledge and Perceptions of STEAM Education in Korea". EURASIA Journal of Mathematics, Science and Technology Education, Vol. 11 № 6, pp. 1321-1338.

[4] Zawieska, K. Duffy, B. (2010), "The Social Construction of Creativity in Educational Robotics". Progress in Automation, Robotics and Measuring Technique, Vol. 351 of the series Advances in Intelligent Systems and Computing, pp. 329-338.

[5] Wyffels, F., Hermans, M., Schrauwen, B. (2010), "Building robots as a tool to motivate students into an engineering education". In: Proc. 1st Int. Conf. on Robotics in Education (RiE 2010), Bratislava, Slovakia, pp. 113–116.

[6] Pérula-Martínez, R., García-Haro, J.M., Balaguer, C., Salichs, M.A. (2015), "Developing Educational Printable Robots to Motivate University Students Using Open Source Technologies". Journal of Intelligent & Robotic Systems. pp 1-15.

[7] Petre, M., Price, B. (2004), "Using Robotics to Motivate 'Back Door' Learning". Education and Information Technologies, Vol. 9 № 2, pp. 147-158.

[8] Alfieri, L., Higashi, R., Shoop,R., Schunn, C.D. (2015), "Case studies of a robot-based game to shape interests and hone proportional reasoning skills". International Journal of STEM Education. Vol. 2 №4.

[9] Alimisis, D. (2012), "Robotics in education & education in robotics: Shifting focus from technology to pedagogy". In: Proc. 3rd Int. Conf. on Robotics in Education (RiE 2012), Prague, Czech Republic, pp. 7–14.

[10] Pina, A., Arlegui, J., Menegatti, E., Moro, M. (2008), Workshop Proceedings of SIMPAR 2008 Intl. Conf. on SIMULATION, MODELING and PROGRAMMING for AUTONOMOUS ROBOTS. Venice(Italy) 2008 November,3-4. pp. 10-21.

[11] Papert, S. (1991), "Situating Constructionism". In S.Papert and I.Harel (eds.) Constructionism, Norwood, NJ, Ablex Publishing Corporation.

[12] Yoon, H., Kim, B.S. (2016), "Preservice Elementary Teachers' Beliefs about Nature of Science and Constructivist Teaching in the Content-specific Contex". Eurasia Journal of Mathematics, Science & Technology Education, Vol.12 №3, pp. 457-475.

[13] Tyler, R.W. (1949), "Basic principles of curriculum and instruction". Chicago: The University of Chicago Press.

[14] Adam, S. (2004), "Using Learning Outcomes", available at: http://www.gov.scot/Publications/2004/09/19908/42704 (accessed 17 April 2016).

[15] Barnett, R. & Coate, K. (2005), "Engaging the curriculum in higher education". Berkshire, GBR: McGraw-Hill Education.

[16] Coate, K. (2009), Curriculum. In M. Tight, K.H. Mok, J. Huisman and C.C. Morphew (eds.) The Routledge International Handbook of Higher Education, New York: Routledge, pp. 77–90.

[17] Mäkinen, M. & Annala, J. (2010), "Meanings behind curriculum development in higher education". PRIME Vol.4 №2, pp. 9–24.

[18] Ceceri, K. (2012), Robotics: Discover the science and technology of the future with 20 project.

[19] Kee, D. (2013), Classroom Activities for the Busy Teacher: A 10 week plan for teaching robotics using the LEGO® Education EV3. Copyrighted Material, USA

[20] Filipov, S.A. (2013), Robotics for children and parents, Fradkova, A.L., St. Petersburg.

[21] Benedettelli, D. (2014), THE LEGO® MINDSTORMS® EV3 LABORATORY build, program, and experiment with wicked cool robots. William Pollock, USA.

[22] Griffin, T. (2014), THE ART OF LEGO® MINDSTORMS® EV3 PROGRAMMING. No Starch Press, USA.

[23] Valk, L. (2014), THE LEGO® MINDSTORMS® EV3 DISCOVERY BOOK. William Pollock, USA.

[24] Isogawa, Y. (2015), THE LEGO® MINDSTORMS® EV3 Idea Book. William Pollock, China.

[25] Pina, A., Arlegui, J., Menegatti, E., Moro, M. (2008), "Robotics, Computer Science curricula and Interdisciplinary activities". Workshop Proceedings of SIMPAR 2008 Intl. Conf. on Simulation, Modeling and Programming For Autonomous Robots. Venice(Italy) 2008 November,3-4. ISBN 978-88-95872-01-8. pp. 10-21.

[26] Alimisis, D. (2009), Teacher Education on Robotics-Enhanced Constructivist Pedagogical Methods. School of Pedagogical and Technological Education. Greece.

[27] Ucgul M. (2012), "Design and development issues for educational robotics training camps". May 2012, 278 Pages, available at: https://etd.lib.metu.edu.tr/upload/12614301/index.pdf (accessed 22 November 2015).

[28] Alfieri, L., Higashi, R., Shoop, R., Schunn, Ch. (2015), "Case studies of a robot-based game to shape interests and hone proportional reasoning skills". International Journal of STEM Education. December 2015, 2:4.

[29] Ospennikova, E., Ershov, M., Iljin, I. (2015), "Educational Robotics as an Inovative Educational Technology", Procedia - Social and Behavioral Sciences 214 (2015) pp. 18 – 26.

[30] Pina, A. (2015), "Improving learning and motivation of students (10-14 years old) by using educational robotics in different scholar scenarios". Informatization of education International Scientific and Practical online-coference, pp.14-18.

[31] Kagan. S. (1989), "The structural approach to cooperative learning - Educational leadership", available at: http://www.moe.gov.bz/~moegov5/images/teachingresources/coopstruct%20article.pdf (accessed 19 April 2016).

[32] Johnson, D.W., Johnson, R.T., Smith, K.A.(1989), "Cooperative learning", CL Center - 1989 - personal.cege.umn.edu, available at: http://personal.cege.umn.edu/~smith/docs/CL%20College-604.doc (accessed 19 April 2016).

[33] Johnson, D.W., Johnson, R.T., Stanne, M.B. (2000), "Cooperative learning methods: A meta-analysis", available at: https://www.researchgate.net/profile/David_Johnson50/publication/220040324_Coope

rative_Learning_Methods_A_Meta-Analysis/links/00b4952b39d258145c000000.pdf (accessed 19 April 2016).

[34] Lucha, Z.T., Bongase, T.M. (2015), "Study on the Practices of Cooperative Language Learning Method: Enango High School Grade 9 in Focus Science", Technology and Arts Research Journal, available at: http://www.ajol.info/index.php/star/article/download/133486/123097 (accessed 19 April 2016).

[35] Hilbert, M. (2015), "Digital Technology and Social Change" [Open Online Course at the University of California] freely, available at: https://canvas.instructure.com/courses/949415 (accessed 22 April 2016).

[36] ICT in Education UNESCO, available at: http://en.unesco.org/themes/ict-education (accessed 02 April 2016).

[37] Bredenfeld, A., Hofmann, A., Steinbauer, G. (2010), "Robotics in Education Initiatives in Europe - Status, Shortcomings and Open Questions". Proceedings of SIMPAR 2010 Workshops Intl. Conf. on SIMULATION, MODELING and PROGRAMMING for AUTONOMOUS ROBOTS. Darmstadt (Germany) November 15-16, 2010 ISBN 978-3-00-032863-3 pp. 568-574.

[38] Strawhacker, A., Bers, M. (2015), "I want my robot to look for food": Comparing Kindergartner's programming comprehension using tangible, graphic, and hybrid user interfaces. Int J Technol Des Educ. 25:293-319 DOI 10.1007/s10798-014-9287-7.

[39] Pisciotta, M., Vello, B., Bordo, C., Morgavi, G.(2010), "A robotic competition: a classroom experience in a vocational school". Advanced educational technologies (edute 10). Book Series: Recent Advances in Computer Engineering, pp.151-156.

An Approach to Enhance Professional Education in the Field of Information Technolohies by Using of ICT-qualifications Framework

Olga Dolinina
Yury Gagarin State Technical University of Saratov
Saratov / Russia
olga@sstu.ru

Abstract

In modern life information technologies (IT) sector promises to become a major driver for modernization and building of information society; the factors of the vast territories and uneven population bring up the importance of the IT solutions as a connectivity element for state and economy management. The internal IT market in Russia is growing rapidly passing economic crisis easily; and the IT-specialists provided by the local educational system are still in demand globally, though there are some important changes in academic approach to be made. One of the main problems of professional IT-training in Russia is the difference between the university's qualifications and real market requirements to job applicants as industry demands concrete IT-skills and knowledge necessary for the job according the IT European Qualification Framework (EQF). Current situation of the university education could be characterized like "each university develops its own courses based on practical knowledge of academic staff more than on real IT-business demands". Russian Governmental approach to modernize the Bachelor & Master education in this field is based on the development of the national qualifications framework and using it for the base of the students training. Building of the effective system of EQF-based system of professional IT-training in Russia and Kazakhstan universities is an objective of the joint European Tempus project "PICTET: EQF-based professional ICT training for Russia and Kazakhstan". System of professional ICT education should be more flexible than classic university degree education and must reflect current labour and business market. The project unites Russian and Kazakh universities, professional IT-companies interested in IT-specialists, Russian Union of IT-directors and EU universities (experienced in professional IT education or staff of which participated in the development of EU e-qualifications framework) from Belgium, Italy, Bulgaria, Greece, Spain, Romanian IT Association. Most of the partner institutions in Russia and Kazakhstan are situated in Russian-Kazakh frontier region and are united not only by the joint educational-business environment but by close collaboration in education and research confirmed by bilateral and multilateral agreements. The system of the professional IT-education based on the EU EQF will be implemented into by the end of 2016.

Keywords

ICT-qualifications Framework

Introduction

In spite of the economic crisis IT sector in Russia and CIS countries promises to become a major driver for modernization and development of the information

society; what's more, the factors of vast territories and uneven population bring up the importance of the IT solutions as a connectivity element for state and economy management.

Russian IT market in a short-range forecast will grow up to $13-27 billions, to become redoubled in comparison with the level of 2010. At the same time, the role of Russian IT is insignificant in the world. The reasons for this are: the decline of engineering education; the "brain drain" process; lack of high-tech industry clusters; loss of research & development (R&D) potential (though Russia is still famous for its specialists in computing mathematics and algorithms). On the other hand, there are some benefits for the increasing of IT development: the most up-to-date technologies are quickly adapting in Russia; leading global companies, such as IBM, Microsoft, HP, Intel, Autodesk are successfully working in Russia and CIS countries; the internal IT market is growing rapidly; and the IT-specialists provided by the local educational system are still in demand globally, though there are some important changes to be made.

One of the main problems of professional IT-training in Russia is the difference between the university's programs of education and real market requirements to job applicants. It is evident that the industry today demands concrete IT-skills and knowledge necessary for the job (according the ICT European Qualification Framework (EQF)) while universities graduates have classic education mainly and they need to be taught on workplaces after joining the company. Optimistic forecast for Russia 2016-2020 (as by Federal Statistic Department) shows the increasing of demand for IT specialists up to 1,6-3.5 mln. It means that the current educational system must be upgrated and enhanced to meet the modern industry requirements.

The state policy documents such as Russian (RU) long-term program of development up to 2020 specifies the deficit of human capital as one of the major problems of economic development. The efficiency of professional training system is determined by industry, which makes the qualification requirements, and the potential employees, whose qualifications are evaluated. The qualification framework is the key instrument for the management of market-education relationship especially in such rapidly growing industry as Information and Communications Technologies (ICT). The new Federal Educational Standard which is compulsory for the Russian universities demands building the Bachelor and Master curricula according the ICT-qualifications in deep collaboration with the business companies. The companies should participate in the university education from the stage of the new curriculum development to the assessment of the students' results.

The similar situation is described in the National Kazakhstan (KZ) Report on Science where it was declared that IT sector can be developed in a broader and more effective manner than in the past. KZ Ministries of Education & Science and

Industry &Trade has also identified IT as the priority industrial area for encouraging investment.KZ "Development Strategy of Kazakhstan until 2030" demonstrates the government's strong commitment to create an independent and effective system of telecommunications services, which will be competitive with analogous infrastructures in more-developed countries. In the Innovation Industrial Development Strategy: 2003-2015 is announced to give "All the possible support to development of the national software products and software technology industry". At the same time analysis of knowledge of the 3256 ICT-staff working in 50 companies made by KZ Association of IT-companies (www.itk.kz) in 2012-2014 showed that there is no system approach to ICT-specialists preparation in KZ and it constrains development of ICT-industry the problem should be solved by implementation of ICT-qualification system.

Russia and Kazakhstan are united by historical and cultural traditions, educational and professional ties, Russian as a common language, geographical proximity of the countries to each other and joint business market especially for neighbourhood regions. More than 18,000 KZ students are enrolled in higher education institutions in Russia, mainly in technical and ICT fields.

In KZ professional ICT training is now realized mainly by special ICT-training centers set up by the software/hardware vendors, and most of Kazakhstan business companies send their staff to Russian institutions for updating ICT-skills. The necessity for KZ universities to improve ICT-training is urgent.

Nowadays situation in ICT professional education in RU and KZ could be generally characterized like "each university develops its own courses based on practical knowledge of academic staff more than on real ICT-business demands".

Building of effective system of EQF-based system of professional ICT-training in RU and KZ universities will help to be flexible to changes in IT-business market, to improve quality of ICT-staff preparation, to implement the united system of ICT-staff retraining based on recognized job profiles, ICT framework qualifications, on ICT business needs; will help universities graduates to start careers and ICT-staff to improve/update their skills and qualifications according to modern tendencies in ICT. System of professional ICT education should be more flexible than classic university degree education and should reflect current labour and business market.

In Europe the e-Competence Framework (e-CF) was developed in 2005-2010 and it united efforts of ICT-educators, ICT-practioners, business companies, social partners. Taking into consideration that ICT business is very international from its origin, implementation of e-CF for joint Russian-Kakazhstan ICT-educational area for building an effective profession ICT-educational system could solve the problems with definition of job profiles, corresponding skills and knowledge and development on this base modern ICT-training system for all levels of studies (Bachelor, Master, professional training programs).

Description of the Tempus project

The idea of the building of the effective university based EQF system of professional ICT-training (SPICT) has been being realised in the Tempus project "EQF-based Professional ICT-training" leading by the University College Ghent (Belgium). The project unites 22 partners from Europe, Russia and Kazakhstan. European partners (University of Library Studies and Information Technologies (Sofia, Bulgaria), TechnoPark MATARO (Spain), Fondazione di Milano (Italy), Alexander Technological University of Thessaloniki (Greece), IT Association of Romania represent universities and companies who participated in the EU projects connected with the development of the EU ICT-qualifications framework and now are assisting RU-KZ partners to create the system of ICT-education.

Background of the RU-KZ consortia is connected with the fact that each Russian university has "neighbour" KZ university with which it has joint/double degree programs and strong cooperation. Many students of Russian universities are KZ citizens, so Russian and KZ universities jointly prepare IT-graduates for Russian and KZ business.

KZ partner universities present all RU-KZ bordering regions Western (Western Kazakhstan Agrarian-Technological University (WKATU)), Central (Karaganda State Technical University (KSTU)), Eastern (Eastern Kazakhstan State Technical University (EKSTU)), Northern Kazakhstan (Rudny Industrial Institute (RII)) and famous Kazakhstan National Al-Farabi (KazNU) University, internationally recognized leader in KZ education. Russian universities are Yury Gagarin State Technical University of Saratov, Novosibirsk State University of Economics & Management, Uljanovsk State Technical University, Astrakhan State Technical University, South-Ural State University.

Feedback from ICT industry in RU and KZ is provided by the famous IT companies and technoparks which have experience in building of special IT-courses for training new staff with collaboration with universities. It provides IT training on business demand and gives IT skills to young entrepreneurs. Important role in accumulative IT-business feedback on project's activities is played by RUCIO which is a union of CIOs of Russia created on the basis of CIO clubs of regions of Russia. It unites more than 700 CIOs of state organizations and commercial enterprises, the most of biggest regions of Russia. RUCIO together with the Ministry of Education and the universities participates in development and implementation of IT curricula both for students, and for IT staff, ICT standards and requirements to IT professions, development of recommendations in the field of information security, examination and propagation of the best IT projects.

Tempus project is designed for strengthening of the links between education and ICT business by enhancing the RU-KZ system of professional ICT-training by

using EQF, building effective System of professional ICT-Education, setting up Network of ICT-training centers in RU/KZ universities for enforcing infrastructure and framework. Wider objective is the improvement of the quality of ICT-specialists preparation by building an effective System of professional ICT-education and strengthening links with business environment in RU and KZ.

The project specific objectives:

- To create e-qualifications framework for Russia and KZ;
- To establish a network of ICT-training centers in the universities of Russia and Kazakhstan;
- To create the new methodology of professional ICT-training based on the EU qualifications framework and on cooperation with ICT business;
- To elaborate new curricula for ICT-qualifications and introduce them into practice of professional training, providing with teaching materials and learning environment;
- To develop a quality assurance mechanisms ensuring the quality of professional training in ICT;
- Dissemination of the system of professional ICT-education, new methodology, teaching materials and methods among ICT-educators and ICT-business.

Academic content of the courses developed in the project is based on the developed system of ICT-training and aimed at giving knowledge and skills on main ICT-job profiles. There are developed 12 courses for training of the most important job profiles:

A) Specialists responsible for the research, development and manufacturing of new products and services: 1) Management Scientist/Researcher, 2)Hardware Designer, 3)System Software and Application Software Developer.

B) Specialists responsible for the application and integration of these products: 4)ICT Business Analyst and Consultant, 5)ICT Infrastructure Analyst and Architect (network engineer), 6)System (HW/SW) Developer, 7)Web Designer and Developer, 8)ICT Project Manager, 9)ICT Sales and Marketing Representative

C) Specialists responsible for the daily operations and maintenance: 10)Infrastructure Operations and Maintenance Engineer, 11) Customer Service and Helpdesk Officer, 12)Technician/Field Support Engineer.

Pedagogical approach is based on studying of modern teaching methodology (active multimedia, e-learning, Web 3.0 etc) which is done by training of RU/KZ teachers at the European universities. All developed ICT-courses are based on the new teaching methodology. Students studying at the ICT-centers at RU/KZ universities are mainly adults who have got already the university grade but could not find good job and decided to change the field of business by selecting the ICT-career. Duration of the training programs is from 40 to more than 500 hours (from 1 month up to 2 years).

In order to evaluate the quality of the ICT-training got at the home Russian and KZ universities selected students who passed corresponding professional computer courses, with good foreign language skills, academic success, motivation are supposed to be sent to EU IT-companies for internship according their ICT-qualification.

The quality of SPICT, new curricula, courses, teaching practices and materials is evaluated in 6 ways: by ICT-companies and by RUCIO (which will spread materials for feedback to 500 ICT-companies in RU and KZ), feedback from local ICT-industries, by internal evaluation made by RU-KZ partners; by student evaluations; by the Academic Boards of each RU/KZ universities; by evaluation of the members of International Association of IT Education (IAITE), professional associations: "Informika", Association of IT-vendors and by external accreditation by the RU/KZ Ministries of Education, by EU evaluation made by the European partners. This allows to get various objective internal and external validation of the project results.

One of the key results of the Tempus project is dissemination of the developed results, first of all the system of the professional ICT-training. Main results are reflected at the Tempus project web-site: *www.pictet-tempus.sstu.ru.* It's important that all RU/KZ partners are members of IAITE which will take part in dissemination of project results for attracting as much students, ICT-educators and ICT-companies. RU/KZ ICT-companies are united into Association of IT-vendors and the project's results will be disseminated via them as well. In October 2016 the dissemination conference will be held at Saratov (Russia); the aim of the conference is to share the project's experience with all Russian and Kazakhstan universities who wish to develop and implement the similar system of professional ICT-training as well with ICT-companies interested in getting specialists.

Results

Russian and Kazakhstan universities have developed the SPICT, set up the ICT-training centers where the students can get necessary ICT-qualification. More than 500 students have passed already the professional ICT-training. Twenty best students who demonstrated the best IT skills and good English language were sent to the European companies of Italy, Belgium, Bulgaria, Greece for the professional internship. The results of the internship were highly evaluated by the Project Coordination Team and by the companies. ICT-curricula and teaching materials are being updated constantly according to the professional business demands. The training materials based on the 12 ICT qualifications are implemented at the web-portal specially developed for the adults who wish to upgrade their ICT knowledge and skills or to get new ICT-qualification. Most of the ICT-training centers have signed the collaboration agreements with the

business companies what allow to get feedback from the industry and make the training .

Conclusion

The on-going Joint European Tempus project "EQF-based Professional ICT-training " allows Russian and Kazakhstan universities to develop an innovative system of professional ICT-education based on the European ICT-qualifications framework. The system is planned to be the base of the professional ICT-training as well as for the undergraduate education (Bachelor Degree programs). The network of the partners participating in the Tempus project consists of the 22 Russian, Kazakhstan and European universities and companies and is lead by the University College Ghent (Belgium). Partners developed 12 courses for training the most important job profiles; there was developed the special web-portal where the ICT-training centers publish the active information about the courses, the training materials as well as information about the regional job vacancies. More than 500 students have passed already the ICT-training in the RU-KZ university ICT-centers and highly evaluated the quality of training. It is supposed that the implementation of the system of the professional ICT-training allows to improve the quality of the preparation of the ICT-specialists in Russia and Kazakhstan and to make universities' ICT-curricula flexible to the business demands.

Didactic Bases for Using E-learning Resources for Raising the Quality of Training

Georgi Petrov Dimitrov[1], Svetlozar Stefanov Tsankov[2], Galina Panayotova[3]
1,3 University of Library Studies and Information Technologies, Sofia, Bulgaria
2Ruse University A. Kunchev, Ruse, Bulgaria
[1]geo.p.dimitrov@gmail.com, [2]stzancov@ami.uni-ruse.bg, [3]panayotovag@gmail.com

1 Introduction

In today's globalized information society e-learning is increasingly popular, which provides flexibility, economy, scalability and standardization in education. In the literature one can find different formulations of the concept of e-learning. However, all are based on the combination and interaction of the following components: *activities for teaching and learning through various electronic media* [2].

Modern innovative pedagogical technologies put into practice a new training model based on complex information interactions between teachers and students achieved through means of information and communication technologies [1]. Apart from posing challenges to learning, this model provides better options for achieving results. The proper use of innovation can improve the process of teaching and learning. In order to effectively use modern technologies, however, they must be combined with effective pedagogical approaches [4].

The issue of improving the quality of teaching has always been contentious and connected with the development of science and technology. This affects the way the organization, forms, methods and means of training are established. The emphasis in modern education is to create an interesting and dynamic learning process with the application of modern information and communication technologies.

Information technologies offer learners considerable flexibility, easy access to information and an opportunity to learn according to their specific needs and individual features. With the creation of the Internet, new communications and virtual environments have changed teaching methods to adapt to constantly changing economic and social conditions.

2 Information modification the process of learning and its didactic provision

Modifying the process of learning by using information technologies can be done provided that easily accessible electronic educational resources have been created.

In the pedagogical practice and the modern information environment the didactic provision of training is increasingly made by electronic teaching materials, textbooks, study guides, encyclopedias, dictionaries, maps, charts,

illustrations, collections of assignments and exercises and methodological guidelines for their solution, questions and tests for self-modeling programs to conduct computer experiments (with the possibility of using specialized databases), complex training programs, programs for conducting quality control over training and the development of students [10].

All of them, along with the electronic textbooks, workshops, guides, separate publications, papers, as well as educational portals and system portals can be considered electronic educational resources. Through them can be organized to a great extent the process of acquiring knowledge and skills. Learners receive a variety of reference and educational information, theoretical knowledge, they acquire skills and habits for practical work and independent work and last but not least, they are able to control the results of their training.

The electronic educational resource is an independent finished product containing information in an electronic form and designed for long-term storage and a repeated use in the learning process [10].

According to Hanson, D., & Maushak, N. E-learning has proved to be an effective educational platform with results similar to the results of the traditional form of learning. [3].

According to Winters, E. The design of the electronic training is "the process whereby information is systematically planned, categorized and organized in order to facilitate the transfer of knowledge and skills to the learners" [6].

To obtain an effective result in the design of an electronic educational resource the tutor should prepare a full set of teaching materials. To create this, the multimedia approach has become increasingly popular for the student is provided with educational resources based on different technologies: print, audio-visual materials and e-learning courses. [11]

E-learning is one of the most effective ways of teaching due to a number of advantages, such as independence of place and time of training, saving time and money and, most notably, degree of control over the learning process that the students receive [3].

The learning software is usually in the form of tutorials, practical exercises and simulations. [11] The form chosen depends on the characteristics of educational content. Electronic educational resources have the advantage of being available twenty-four hours a day and students can use them at any time and any place.

3 Basic pedagogical aims when implementing e-learning resources in training

The interactivity of electronic educational learning environments provides students with an access to the huge amount of information in various forms, control over the process of learning and develops their potential for cooperation with the media and other people.

The electronic educational resource is a complex product, where the achievements of modern technology, subject area content and methodology of training, design and artistic qualities are integrated. All known means for provision of information are included: text, sound, photography, video, graphics, animation, interactive components and virtual reality.

When applying e-educational resources in learning, created with the help of modern educational technologies, the following aims can be pointed out [9]:

1) Personality development and learner's readiness to use electronic learning resources in real life.

In recent years, the role and place of personal computers, information and educational technology in society has changed. People effectively using technology and information have a new style of thinking, learning a different approach in assessing the problems and various methods of organizing their activities.

- Development of thinking (visual and active, visual and imagery, intuitive, creative and theoretical thinking);
- Aesthetic upbringing (using the capabilities of computer graphics and multimedia);
- Development of communicative skills;
- Developing skills for making an optimal solution or offering options for solutions in complex situations (use of computer games, selection of optimal actions when making a decision);
- Developing skills for experimental and research activities (realizing the potential for computer modeling) or using computer technologies and electronic educational resources;
- Formation of information culture, skills for carrying out data processing (using integrated custom software, different graphics and video and sound editors) [9].

2) Supporting all levels of the learning process

- Increasing the efficiency and quality of the learning process with the use of electronic educational resources;
- Providing incentives, causing activation of cognitive activities (use of computer visualizations of academic information, participation in game situations, management possibilities, choice of learning modes);
- Deepening of interdisciplinary links by using modern means of information processing, including audio-visual, in solving problems from different subject areas.

These pedagogical aims define the main directions of the implementation of electronic educational resources in education, namely [9]:

Use of electronic educational resources as a tool for learning, improving the teaching process, increasing its efficiency and quality. What is provided by that is:

- Using the capabilities of the software and the methodical provision of modern PCs to present knowledge, to model learning situations, to conduct seminars, to exert control over learning outcomes;
- Use of object-oriented programming tools and systems for the preparation of texts, spreadsheets, databases, etc. to form cultural and educational activities;
- Using the capabilities of artificial intelligence
    - Use of electronic educational resources as tools of knowledge.
    - Use of electronic educational resources as a means of creative development of the personality of students.
    - Use of electronic educational resources as a means of information and methodological provision and management of the educational process.
    - Use of electronic educational resources as a tool for automation of management processes, correction of results of learning activities, computer pedagogical testing and psycho-diagnostics.
    - Use of electronic educational resources as a means of independent activity of students.
    - Intensification and improvement of the management of schools and learning processes based on the use of modern information technologies and electronic educational resources [8, 10].

Electronic educational resources have a positive impact on the learning process. Some of their advantages, in comparison with traditional means of teaching and learning, are to provide opportunities for:

- Active learning – students are engaged and actively participate in the learning process rather than being passive recipients of information.
- Personalization and differentiation of training related to the content, the volume, the pace of development, the level of detail depth. This includes taking into account individual characteristics, interests and abilities of students and selection of content, forms, methods, pace and volume to create optimal conditions for each student to acquire knowledge and skills.
- Possibility to select and replay educational content using multimedia resources;
- Self-preparation and self-education. Using the capabilities of artificial intelligence systems creates a prerequisite for conducting a process of self-study, develops skills of self-presentation and retrieval of knowledge, helps to develop analytical thinking and personal development of the student [7].

- New tools to access the vast amount of information - Internet databases, web sites, libraries, electronic encyclopedias, etc.;
- A new way of communication between participants in the learning process, including cooperative training. The simultaneous development of communications and IT, which are the main means of communication and collaboration, providing students with unparalleled opportunities for communication and sharing of information. The world is becoming more localized and linked thanks to new ways of social interaction;
- Self-check and assessment using electronic and web-based tests;
- Increased motivation to learn. The use of multimedia and audio-visual aids provides intensive forms and methods of training, conducting independent learning activities, which increases the motivation of students and the level of emotional perception of information [5].

4 Conclusion

In conclusion it can be said that the introduction of new information technologies in education leads to new training methods based on electronic means of processing and presentation of information. The advent of powerful computer multimedia systems and interactive computer programs has become the basis for an intensive development of e-learning.

Despite the variety of information and computer technologies used in the learning process, it should be noted that the quality of education depends primarily on the study material, ways of presentation and organization of learning.

The introduction of computer and multimedia tools in the learning process not only frees the teacher from routine work in the organization of the educational process, but also enables the creation of rich reference and illustrative material.

The advantage of electronic educational resources is that students can learn and practice anywhere, anytime. These resources can not replace the tutor, but can be used as an aid in teaching and learning. The form that is selected depends on the characteristics of the educational content. Thus the traditional way of teaching can be successfully combined with the use of electronic educational resources in order to achieve a quick and permanent acquisition of the necessary knowledge and its successful implementation.

References

1. Зонева, Л. К. Използване на електронни образователни ресурси в технологичното обучение, ЮЗУ „Неофит Рилски", Благоевград.
2. Тупаров, Г., Дурева, Д., (2008), Електронно обучение. Технологии и модели, ЮЗУ „Неофит Рилски", Благоевград, с. 31.
3. Hanson, D., & Maushak, N., (1996), Distance education: Review of the literature (2nd ed.). Ames, IA: Research Institute for Studies in Education.
4. Kwan, R., Robert Fox, F. T. Chan, Philip Tsang, (2008), Enhancing Learning Through

Technology Research on Emerging Technologies and Pedagogies, *World Scientific Publishing Co. Pte. Ltd*., p. 292.
5. Sandlin, J., B. Schultz, J. Burdick., (2010), Handbook of Public Pedagogy. *Education and Learning Beyond Schooling*, Taylor & Francis, 709 p.
6. Winters, E., (2016, May), Glossary. <www.ewinters.com/Glossary.html>.
7. Woolf, B., (2009), Building Intelligent Interactive Tutors Student-centered strategies for revolutionizing e-learning, *Elsevier's Science & Technology*, UK, 480 p.
8. Гурьев, С. В., (2002), Использование компьютера как инструмента образовательного процесса [Текст]/С.В.Гурьев. – М.: *Просвещение,* 234 с.
9. Роберт, И. В., (2007), Теория и методика информатизации образования (психолого-педагогические и технологические аспекты). – М.: ИИО РАО, 234 с.
10. Федотова, Е. Л., Федотов, А. А., (2010), Информационные технологии в науке и образовании М.: *ИД Форум*, ИНФРА-М, 275 с.
11. Чантов, В., (2010), Мултимедията и принципи в теорията за ученето, Нови информационни технологии в образователния процес, София: *За буквите – О писменех*, с. 206-214

Learning in a Smart City Environment (print+online)

R. Nikolov[1], E.Shoikova[2], M. Krumova[3], E. Kovatcheva[4],
V. Dimitrov[5], A. Shikalanov[6]

[1,2,4,5,6] University of Library Studies and Information Technologies,
[3]Technical University – Sofia
[1]r.nikolov@unibit.bg, [2]e.d.shoikova@gmail.com,
[3]mkrumova@tu-sofia.bg,[4]e.kovatcheva@unibit.bg, [5]wdimitr@gmail.com,
[6]ctmdevelopment@yahoo.com

Abstract

Advances in technology in recent years have changed the learning behaviors of learners and reshaped teaching methods and learning environments. The purpose of this paper is to overview a foundational framework and provide models for the planning and implementation of smart learning environments. Gartner's 2015 Hype Cycle for Emerging Technologies identifies the computing innovations such as Internet of Things, Advanced Analytics, Machine Learning, Wearables etc. that organization should monitor. Learners and students, being the future drivers of these industries, are the main human resource to fulfill the vacancies of these work forces. Constant improvements in and re-evaluation of the curriculum taught to the learners has to be done regularly to keep the learners up-to-date in fulfilling the requirements of these industries and corporations. Universities benefit from these thinking "out of the box practices" by equipping students with work force experience that involves more hands on task with real life infrastructures. Introduction is focused on analysis of emerging industries and new types of jobs that are requiring future personnel to be well equipped to meet the need of the expansion requirements of these industries and keep up with their development needs. Section 2 looks at future Internet domain landscape that comprises a great diversity of technology related topics involved in the implementation of Smart Learning Environments. The purpose of section 3 is to overview a foundational framework and major considerations for the planning and implementation of smart learning environments, behind which is the convergence of advances and developments in social constructivism, psychology, and technology. Section 4 introduces the smart learning models, which are developed to reflect the dynamic knowledge conversion processes in technology enabled smart learning environments. The last section presents a case study of a learning scenario entitled "Monitoring the environmental parameters in a Smart City"as an illustration of experimental learning on Internet of Things, which proofs the power of FORGE (Forging Online Education through FIRE) FP7 project methodology and infrastructure for building remote labs and delivering them to students.

Keywords:

Smart city. Smart learning environment. Full context awareness. Big data and learning analytics. Autonomous decision-making. SECI. Learning scenario. Forging Online Education through FIRE.

Introduction

New forms of industries and new types of jobs are emerging, requiring future personnel to be well equipped to meet the need of the expansion requirements of these industries and keep up with their development needs. Gartner's 2015 Hype Cycle for Emerging Technologies identifies the computing innovations that organizations should monitor (see Fig. 1). Learners and students, being the future drivers of these industries, are the main human resource to fulfil the vacancies of these work forces. Constant improvements in and re-evaluation of the curriculum taught to the learners has to be done regularly to keep the learners up-to-date in fulfilling the requirements of these industries and corporations. Universities benefit from these thinking "out of the box practices" by equipping students with work force experience that involves more hands on task with real life infrastructures.

Figure 1 Gartner's 2015 Hype Cycle for Emerging Technologies

Today, as education systems are currently undergoing significant change brought about by emerging reform in pedagogy and technology, our efforts have sought to close the gap between technologies as educational additive to effective integration as a means to promote and cultivate student centred, inquiry based and project based learning. Moving forward, many of the advances in education will be brought about by further integration of personalised learning into the smart learning environment, such as ubiquitous access to technology through continuously shifting mobile devices and mobile platforms, cloud based services, big data. Dispersed learning environments will further emphasise the affordances of learning technologies. These changes are also being impacted by broader trends including population shifts, economics, employment, and other societal shifts.

Smart City Concept

This section covers smart city definitions as well as some of those technology trends that are most connected to the development of smart cities and smart learning environments.

Definitions

There are many definitions for smart cities in use globally (ISO/ IEC JTC1 2014) [1]. Smart city is a new concept and a new model, which applies the new generation of information technologies, such as the internet of things, cloud computing, big data and geospatial data integration, to facilitate the planning, construction, and management of smart services. Developing smart cities can benefit synchronised development, industrialisation, informationisation, urbanisation and agricultural modernisation and sustainability of cities development. Smart city is a term denoting the effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens. The "smartness" of a city describes its ability to bring together all its resources, to effectively and seamlessly achieve the goals and fulfil the purposes it has set itself. A smart city can be viewed as a combination of four Internets or networks: Internet of Things, Internet of People, Internet of Data and Internet of Services. The emphasis is put on the system integration and synergistic characteristic of a smart city (Fig.2). Such a view illustrates succinctly the 'glue', or the system integration property that ICT provides in smart cities.

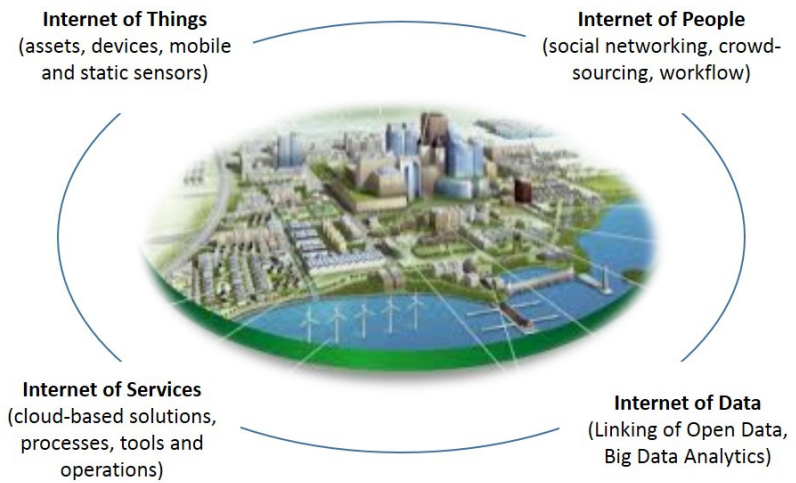


Figure 2 The smart city as a set of 'Internets'

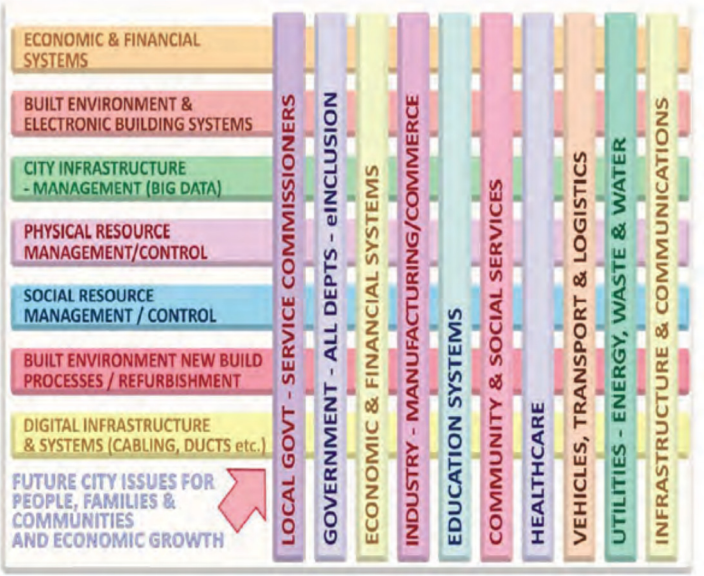


Figure 3 An Enterprise Architecture View of Smart City

An enterprise architecture view emphasises from a domain and outcome perspective, and presents how the ICT in a smart city would break value by breaking 'silos'. There we see the education systems in a smart city context (Fig.3).

Technology trends

The future Internet domain landscape comprises a great diversity of technology related topics involved in the implementation of smart cities and smart learning environments developments.

Ubiquitous computing is a concept in software engineering and computer science where computing is made to appear everywhere and anywhere. In contrast to desktop computing, ubiquitous computing can occur using any device, in any location, and in any format. A user interacts with the computer, which can exist in many different forms, including laptop computers, tablets and terminals in everyday objects.

Networking technologies that are about bringing higher broadband capacity with FTTH, 4G LTE and IP Multimedia Systems provide the infrastructure of the smart cities to make all the devices, computers and people can have convenient, reliable, secretive communication paths with each other. Ubiquitous computing is also described as pervasive computing, ambient intelligence, or "everyware".

Open Data in the context of smart cities generally refers to a public policy that requires public sector agencies and their contractors to release key sets of government data to the public for any use, or re-use, in an easily accessible manner. In many cases, this policy encourages this data to be freely available and distributable.

Big data is a blanket term for any collection of data sets so large, complex and rapidly changing that it becomes difficult to process using traditional database management tools or traditional data processing applications. A smart city, as a "system of systems", can potentially generate vast amounts of data. The challenges include capture, curation, storage, search, sharing, transfer, analysis and visualisation.

A **geographic information system (GIS)** in smart cities is used to provide location based services. The implementation of a GIS in smart city is often driven by city jurisdictional, purpose, or application requirements. GIS and location intelligence applications can be the foundation for many location-enabled services that rely on analysis, visualization and dissemination of results for collaborative decision making.

Cloud computing (**public, private or hybrid)** is the delivery of computing as a service rather than a product, whereby hared resources, software, and information are provided to computers and other devices as a utility over the Internet.

Service-oriented architecture (SOA) is a software design and software architecture design pattern based on distinct pieces of software providing application functionality as services to other applications. SOA can leverage a world of multiple vendors that build systems, which create interoperability and use each other's capabilities.

The **E-Government** essentially refers to the utilisation of IT, ICTs, and other web-based telecommunication technologies to improve and/or enhance on the efficiency and effectiveness of service delivery.

Embedded networks of sensors and devices into the physical space of cities are expected advancing further the capabilities created by web 2.0 applications, social media and crowdsourcing. A real-time spatial intelligence is emerging having a direct impact on the services cities offer to their citizens. Collective intelligence and social media has been a major driver of spatial intelligence of cities. Social media have offered the technology layer for organising collective intelligence with crowdsourcing platforms, mashups, web-collaboration, and other means of collaborative problem-solving. Smart cities with instrumentation and interconnection of mobile devices and sensors can collect and analyse data and improve the ability to forecast and manage urban flows, thus push city intelligence forward.

The **Internet of Things (IoT)** refers to the interconnection of uniquely identifiable embedded computing like devices within the existing Internet infrastructure. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications and covers a variety of protocols, domains, and applications. Internet of Things including sensor networks and RFID is an important emerging strand. These technologies overcome the fragmented market and island solutions of smart cities applications and provide generic solutions to all cities. A new round of applications, such as location aware applications, speech recognition, Internet micro payment systems, and mobile application stores, which are close to mainstream market adoption, may offer a wide range of services on embedded system into the physical space of cities. Augmented reality is also a hot topic in the mobile devices and smart phones, enabling a next generation location-aware applications and services.

Conceptualising the emerging field of smart learning environments

Given the power and potential of new and emerging technologies, it is time to conceptualise how learning environments can be made smarter (i.e. more effective, efficient and engaging) on a large and sustainable scale. The purpose of this section is to overview a foundational framework for the planning and implementation of smart learning environments, behind which is the convergence of advances and developments in epistemology, psychology, and technology. A few definitions are needed to motivate the discussion (Richey, Klein, & Tracey, 2011; Seel, 2012; Spector, 2012 [2,3,4]). Recently smart learning is being defined and studied in diverse ways.

Smart learning environment definitions

The International Association for Smart Learning Environments [5] embraces a broad interpretation of what constitutes a smart learning environment. A learning environment can be considered smart when it makes use of adaptive technologies or when it is designed to include innovative features and capabilities that improve understanding and performance. In a general sense, a smart learning environment is one that is effective, efficient and engaging. According to Spector (2014) what is likely to make a learning environment effective, efficient and engaging for a wide variety of learners is one that can adapt to the learner and personalise instruction and learning support [6]. This suggests that appropriate adaptation is a hallmark of smart behaviour. The adjective 'smart' is used in everyday language to refer to an action or decision that involved careful planning, cleverness, innovation, and/or a desirable outcome (Spector et al., 2015) [7]. Learning generally involves a stable and persisting change in what a person or group of people know and can do. Intentional learning can occur in a formal context as well as in informal contexts. The notion of an environment suggests a place or surroundings in which something occurs. Whether physical or virtual, an environment can be conducive

to or inhibitive of learning. A smart learning environment, in keeping with the emphasis on efficacy, is one that is generally conducive to and supportive of learning. Kinshuk (2010) emphasised that smart learning is different from e-learning using smart devices, and Ktoa (2012) defined smart learning as 'smart device-based intelligent, customised learning service [8]. Broadly defined, smart learning environments represent a new wave of educational systems, involving an effective and efficient interplay of pedagogy, technology and their fusion towards the betterment of learning processes. Various components of this interplay include but are not limited to: (1) Pedagogy: learning design, learning paradigms, teaching paradigms, environmental factors, assessment paradigms, social factors, policy; (2) Technology: emerging technologies, innovative uses of mature technologies, interactions, adoption, usability, standards, and emerging/new technological paradigms (open educational resources, learning analytics, cloud computing, smart classrooms, etc.); (3) Fusion of pedagogy and technology: transformation of curriculum, transformation of teaching behaviour, transformation of learning, transformation of administration, transformation of schooling, best practices of infusion, piloting of new ideas. A learning environment can be considered smart when the learner is supported through the use of adaptive and innovative technologies from childhood all the way through formal education, and continued during work and adult life where non-formal and informal learning approaches become primary means for learning. Smart learning environments are neither pure technology-based systems nor a particular pedagogical approach. They encompass various contexts, in which students (and perhaps teachers) move from one context to another. So, they are perhaps overarching concept for future academia. This perspective has the potential to overcome some of the traditions of institution based instruction towards lifelong learning.

Considerations of smart learning environments development

There are several major features of the development of smart learning environments that separates smart learning environments from other advances in learning technologies. These are full context awareness, stacking vs. replacing the LMS, big data and learning analytics, and autonomous decision making.

Full context awareness. Boulanger et al. (2015) [9] indicated that smart learning environments involve context awareness that can combine a physical classroom with many virtual learning environments. This could provide full context awareness by combining smart learning environments with holistic Internet of Things and ubiquitous sensing devices, e.g., wearable technologies such as smart watches, brainwave detection, and emotion recognition (Li et al. 2015 [10]). Full context awareness enables smart learning environments to provide learners with authentic learning contexts and seamless learning experiences to fuse a variety of features in the e-learning environments. The system includes

learning management systems, mobile and ubiquitous learning systems, various artificial intelligence based adaptive and intelligent tutoring/learning systems. These systems would assist teachers and instructors in direct monitoring of the learning environment, understand learners' conditions and give learners real-time adaptive assistance, while at the same time facilitating independent learning for the learners (Hwang 2014 [11]).

Stacking vs. Replacing the LMS. While many organizations have grown beyond the current capacities of their Learning Management Systems (LMS), there are significantly fewer organizations choosing to make the major capital and implementation investment of replacing their entire enterprise learning technology. Rather, we are seeing more "Stacking" - which means accepting the role of the existing LMS as the base system for the organization and then adding Stacks or Layers on top that will create added and more targeted functionality. Some of the Learning Stacks include: Competency or Talent Management Layers; Assessment or Feedback Layers; Compliance or Regulatory Layers; Career Development Layers; Collaboration and Social Networking Layers, Gamification or Engagement Layers, Globalisation Layers. In other words, some organizations are shifting from replacing their LMS to adding these technologies on top of the LMS. It might be called a "LMS Inside" approach as extensions of the LMS, using the core code for transaction tracking and shared data exchange - but the functionality is found in the layer.

Big data and learning analytics. Smart learning environments need to consider advanced data manipulation techniques such as employing big data and learning analytics to collect, combine and analyse individual learning profiles in order to scientifically generalise and infer each individual learning need in real time in ubiquitous settings that encompass both physical and online activities. Learning analytics by using big data can monitor individual learners' progress and behaviour continuously in order to explore factors that may influence learning efficiency and effectiveness (Kumar et al. 2015a, b [12]).

Autonomous Decision Making and Dynamic Adaptive Learning. Another important feature of smart learning environments, which is different from other learning environments, is their autonomous knowledge management capability that enables them to automatically collect individual learners' life learning profiles. As Kay (2008) [13] mentioned, smart learning environments can precisely and autonomously analyse learner's learning behaviours in order to decide in real time, for example, what interactions with the physical environment to recommend to the individual learners to undertake various learning activities, the best location for those activities, which problems the learners should solve at any given moment, which online and physical learning objects are the most appropriate, which tasks are the best aligned with the individual learner's cognitive and meta-cognitive abilities, and what group composition will be the most effective for each group member's learning

process. Such autonomous decision making and dynamic adaptivity has the potential to generalise and infer learners' learning needs in order to provide them with suitable learning conditions. It is a challenge for smart learning environments to collect these data about the learners and their environment from disparate sources in both physical and online components of the ubiquitous settings.

Smart learning environments foundation areas

According to Spector (2014) social constructivism, psychology and technology are the foundation areas that provide meaningful and convergent input for the design, development and deployment of smart learning environments. At a high level, social constructivism provides a coherent approach to many human activities, including learning design and technology research and practice. It consists of two primary tenets that describe how humans develop knowledge and expertise. The *first tenet* involves the creation of mental models when encountering new or unusual or otherwise unexplained experiences. Simply stated, this is the notion that people create internal representations to make sense of their experience. This perspective puts the individual at the centre of knowledge and skill development, and it implies that individuals may develop knowledge and skills differently. The *second tenet* from a philosophical perspective involves the role of language as a critical mediator in learning and knowledge development. The underlying idea is that interaction with others, especially in the form of discourse, contributes to how knowledge is developed. Taken together, these two tenets provide a general description of how people come to know and understand their worlds – namely by a process of creating internal mental representations and then sharing ideas formed on the basis of those representations with others through appropriate languages and media. Because social constructivism provides a coherent philosophical foundation for learning and instruction, it should be recognised as a pillar of any smart learning environment.

The role of psychology in learning and instruction is well recognised. The two main streams of educational psychology have been behaviourism and cognitivism. Behaviourism emphasises things that can be observed and measured as a way to understand and predict human behaviour. The emphasis on outcomes is a valuable contribution of behaviourism that is worth retaining in understanding smart learning environments. Cognitivism emphasises the need to understand mental processes that underlie and can explain many human behaviours. Social psychology emphasises the effects and impact of others on how people think and behave. There is a strong parallel between social psychology and its relationship to behavioural and cognitive psychology. People do not live and learn in isolation from others. A smart learning environment will take this fact into account explicitly and in meaningful ways.

Learning technology regularly undergoes changes in response to changes in mainstream models of human cognition and learning. Modern information and communications technologies are expected to support and strengthen the processes of creating, transforming and sharing knowledge in a smart environment. This often requires an innovative use of a technology in an engaging and flexible manner. Web 2.0 and Social 3.0 have captured the interest and the imagination of students, educators and researchers.

Web 2.0 presents opportunities for teachers to build higher levels of engagement in the classroom. Giving students the ability to think critically about transferring skills and knowledge to new creations teachers use Web 2.0 to encourage students to view themselves as active agents in the transfer process. The impact of Web 2.0 has instrumentally changed the way students learn and in return the way teachers must teach. The number of Web 2.0 tools continues to grow while utilisation of these tools supports constructivist pedagogy. The interactive nature of these technologies lends itself well to collaborative learning, which motivates students, creates a "safer" learning environment, and enhances knowledge and skills. Users become creators, collaborators and actively engaged with Web 2.0 tools.

As broadband penetration increases, people become more empowered to connect with each other on their own terms. "Social Media" as we know it is just to describe the nature of sharing online. From Facebook and Twitter to Snapchat and Whatsapp, the apps for online sharing vary as much as the Web 2.0 products. While there is power in collaboration, concern exists too. The impact of these technologies upon culture, education, and knowledge is clear. According to Norris and Soloway [14], Social 3.0 is defined as: two or more individuals verbally conversing; while those two or more individuals are engaged doing "something" inside an app or in a Web page; and while those two or more individuals are either co-located, or more interestingly, not co-located. Thinking of tools in terms of students level of knowledge creation, the hierarchy of revised Bloom's Taxonomy (Fig.4) will enhance appropriate understanding.

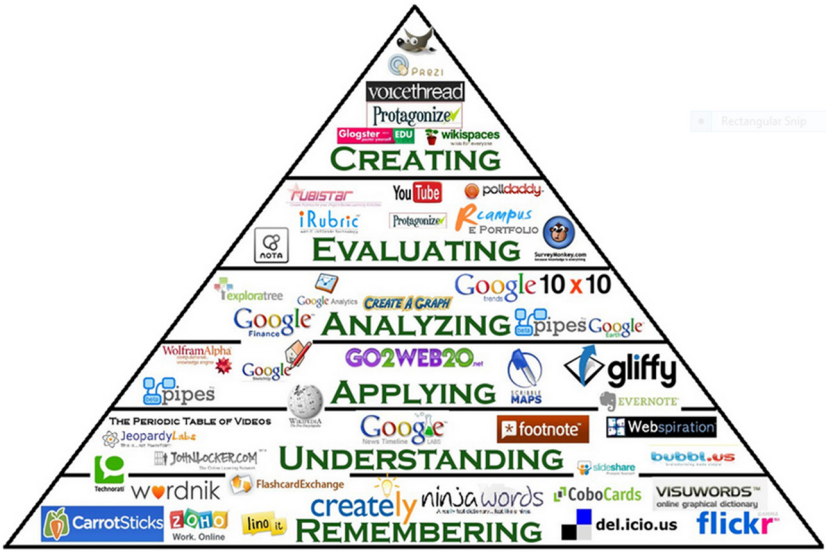


Figure 4 The hierarchy of revised Bloom's Taxonomy supported by technologies

Smart Learning Design Model

There is no single or simple way to characterise knowledge development. People create internal representations and then talk about those representations with others along various paths to understanding. People are smart in different ways, at different times, and in different circumstances. In response to the uncertainty regarding opportunities and challenges facing education systems in transforming the classroom into effective teaching and learning environments, we have explored innovative uses of technology that supports new ways to explore, learn, and share knowledge in technology enabled smart learning environments. Transforming the process of teaching and learning means that teachers create fundamentally different learning environments and promote interactivity, socialisation, externalisation, combination and internalisation thus create knowledge as stated by Nonaka and Takeuchi [15]. On this point of view learning design and developing of interactive learning scenarios and activities are critical for the successful development of any learning environment supported by today`s physical environments that are enriched with digital, context-aware and adaptive devices, to promote better and faster learning (Fig. 5).

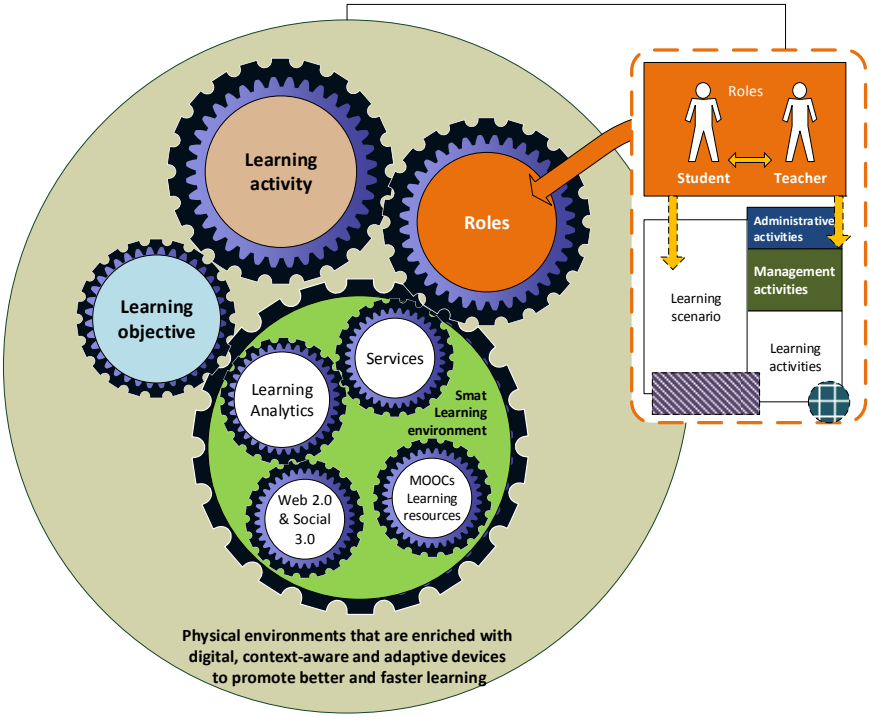


Figure 5 Innovative learning scenario and activities supported by smart learning environments

The interplay between dynamic knowledge conversion processes in technology enabled smart learning environments enhanced by innovative learning scenario is the basis behind the proposed model, which is depicted in Fig.6. The model reflects an emphasis on the knowledge creation that can foster learning outcome. Drawing on IMS LD specifications [16] and current technology innovation, we assumed that the commitment and the creativities of individual users (teachers) are crucial to developing new practices and approaches. The scenarios can be defined as narrative descriptions of preferable learning contexts that take into account user stories, including the description of resources and the functionalities needed, the interactions they have, the tasks they perform and the aims of their activities. The SECI model is the essence of knowledge management. With this mode, we can grow to complex model creating complementary models and using support tools. In each of the four SECI knowledge conversion stages diversity learning activities supported by smart technology can take place. The central thought of the model is that knowledge held by individuals is shared with other individuals so it interconnects to a new knowledge. The spiral of knowledge or the amount of knowledge grows all the time when more rounds are done in the model. Knowledge creation can be viewed as a bottom-up spiral process, starting with the sharing

of tacit knowledge at the individual level and moving to crystallisation of the knowledge at the group level and then on to the organisational level. Then the combination process deductively produces increased collective understanding, which is then internalised by reflection and embodied into increased individual understanding. In each one SECI stages a wide range of smart learning scenarios and activities performed in collaborative and knowledge platforms (Animoto, Proshow, Prezi, Vuvox, Screenr, Quiz-Creator, Bitrix24, Flipsnack, ProProfs, Voci…) and supported by smart technologies and services can be applied.

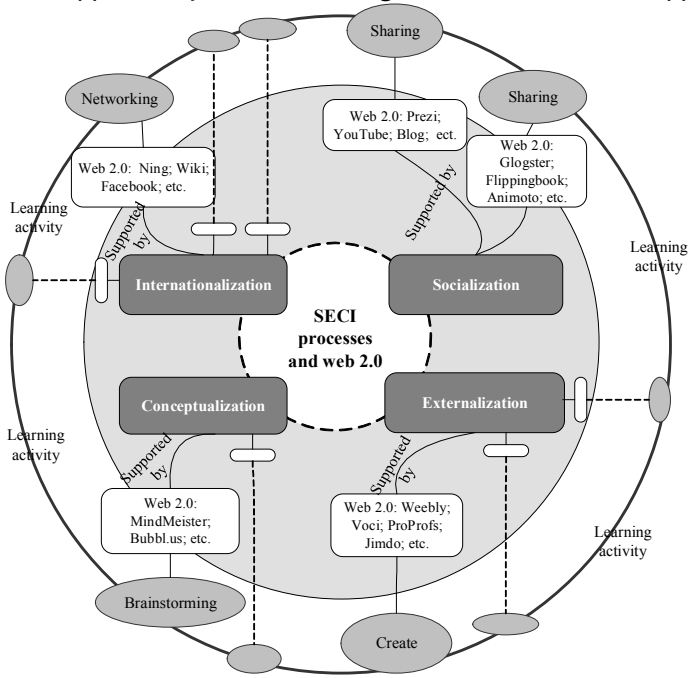


Figure 6 SECI 2.0 - Dynamic knowledge conversion processes in technology enabled smart learning environments

Smart technology attuned to the emergent nature of thinking and learning not just points to greater control over the students, but emphasis shifts to control of productive interaction between students, teachers, ideas and technologies. The rapid progress of mobile, wireless communication and sensing technologies has enabled the development of context-aware ubiquitous learning environments, which are able to detect the real-world learning status of students as well as the environmental contexts.

Case study

Synergy with the FP7 FORGE project "Forging Online Education through FIRE"

The University has started to adopt co-op and internship programs with FP7 FORGE project "Forging Online Education through FIRE" (2016) [17] to facilitate experiences, particularly in computer science programs. The EU Future Internet Research and Experimentation (FIRE) [18] initiative creates an open research environment that facilitates strategic research and development of new Future Internet concepts, giving researchers the tools they need to conduct large-scale experiments on new paradigms. The FORGE project introduces the FIRE experimental facilities to the eLearning community, in order to promote experimentally driven research in education by using experiments as an interactive learning and training channel both for students and professionals. FORGE provides learners and educators with access to world-class experimentation facilities and high quality learning materials via a rigorous production process. In FORGE, we focus on development methodologies and best practices for remote experimentation performed on top of FIRE facilities.

The University delivers the The User Experience Design(UXD) for IoT Specialisation in the Software Engineering Master Program, which heavily relays on present research and the FORGE eLearning methodology and tools having the opportunity to study in depth various aspects of networking protocols and infrastructure, watch instructional movies and screencasts, as well as conduct experiments using the FIRE infrastructure. The goal of the Specialisation program is to provide graduates with theoretical knowledge, practical skills and tools necessary to begin the professional practice of designing user-centric next generation devices. Graduates of this program will be able to implement a holistic, multidisciplinary approach to the design of user interfaces for Internet of Things products, defining their form, behaviour, and content. This Specialisation covers the foundation of UXD (Emotive UXD, Personalized UXD, and Visual UXD) and the development of Internet of Things products and services—including devices for sensing, actuation, processing, and communication—to help them develop skills and experiences they can employ in designing novel systems. The Specialisation has theory and lab sections. In the IoT lab sections students will learn hands-on IoT concepts such as sensing, actuation and communication. The FORGE model and methodology employed for the development of interactive lab in the field of Internet of Things is aimed at fostering remote experimentation with real production system installed in the smart city, such as Smart Santander [19]. A FORGE enabled course will keep a low complexity for setting up simple experiments on FIRE facilities, for both learners and teachers, while making them aware that they are using real resources remotely. On one hand, teachers will use FORGE tools to create simple experimentation scenarios and inject them into their courses. These tools will

ease the process of browsing, reserving and scheduling FIRE resources while pointing and using tools that FIRE already offers. On the other hand learners will be initially guided to focus on studying a specific subject and then, later on, experiment with aspects of this subject onto a real infrastructure. At the end of the course, learners will be guided to re-create the experimentation environment by using the FIRE facility. Thus, learners in the end will have a good understanding of what is FIRE, what it offers and how it can be used. To promote the concept of experimentally driven IoT research in education following requirements have to be considered: Realism of experimentation environment; Heterogeneity of IoT devices; Adequate scale; Mobility support from controlled to realistic; Concurrency; Repeatability and replayability; Real end user involvement in the experimentation cycle; Federation with other Internet research facilities.

As an illustration of experimental learning on IoT, a learning scenario entitled "Monitoring the environmental parameters in smart city" is presented, which proofs the power of FORGE methodology and infrastructure for building remote labs and delivering them to students.

Learning scenario: Monitoring the environmental parameters in Smart City

Aim: In this experimental lab students will learn hands-on IoT concepts, such as sensing and communication in smart city.

Smart environment: Smart Santander[19] infrastructure and its interactive online site, which is conceived as a 3-tiered approach and defined next:

1. IoT node: Responsible for sensing the corresponding parameter (temperature, CO, noise, light, car presence, soil temperature, soil humidity). The majority of them are integrated in the repeaters, whilst the others standalone communicating wirelessly with the corresponding repeaters (it is the case for the parking sensor buried under the asphalt). For these devices, due to the impossibility of powering them with electricity, they must be fed with batteries.

2. Repeaters: These nodes are high-rise placed in street lights, semaphores, information panels, etc, in order to behave as forwarding nodes to transmit all the information associated to the different measured parameters. The communication between repeaters and IoT nodes performs through 802.15.4 protocol.

3. Gateways: Both IoT nodes and repeaters, are configured to send all the information (through 802.15.4 protocol), experiment-driven as well as service provision and network management to the gateway. Once information is received by this node, it can either store it in a database which can be placed in a web server to be directly accessed from internet, or send it to another machine

(central server), through the different interfaces provided by it (WiFi, GPRS/UMTS or ethernet).

Within the Smart Santander project more than 2,000 environmental monitoring sensors have been already deployed. These sensors are monitoring CO index, temperature, noise level and light intensity.

Learning activities:

1. Navigate through the various parts of the Smart Santander (http://maps.smartsantander.eu/) and become familiar with the capabilities of the freely accessible platform tags - IoT infrastructure, Mobile Sensing, Pace of the City, Augmented Reality POIs and play with consideration of various parameters.
2. Explore the Smart Santander IoT infrastructure and examine the set of parameters of the environment, the system is able to monitor.

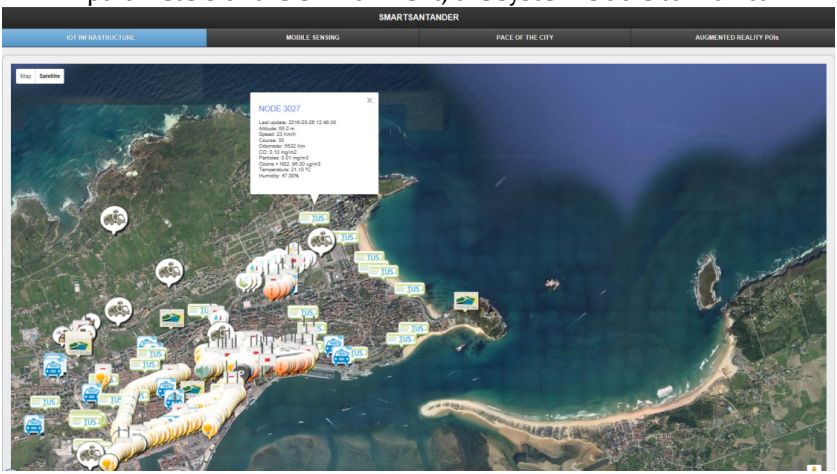


Figure 4 Smart Santander IoT Infrastructure

3. Find on the Internet intelligent sensors or complete devices that can measure the same set of parameters.
4. Explore the features of smart sensors for air pollution, for example C02, O3, particulate matter and ZO2.
5. Design of a "Network of sensors and system for continuous monitoring of the air".

Further, to support the learning process a hybrid cloud infrastructure has been established, which integrates variety of collaboration platforms and LMS. The cloud based infrastructure enables innovative learning scenario execution and monitoring.

Conclusion

This paper discusses a vision and some steps toward development of smart learning environments. These environments are expected to break the boundaries of the traditional learning and enable the detection of the learner's location, environment, proximity and situation. This would provide a fully contextualised learning process in order to provide learners with learning scenarios in their own living and work environments, leading to significantly better learning experiences.

References:

[1] ISO/ IEC JTC1, Smart Cities Preliminary Report 2014. www.iso.org

[2] RC Richey, JD Klein, MW Tracey, (2011), The instructional design knowledge base: Theory, research, and practice (Routledge, New York)

[3] NM Seel (ed.), (2012), The encyclopedia of the sciences of learning (Springer, New York)

[4] JM Spector, (2012), Foundations of educational technology: Integrative approaches and interdisciplinary perspectives (Routledge,New York)

[5] IASLE http://www.iasle.net/

[6] JM Spector (2014) Conceptualizing the emerging field of smart learning environments Smart Learning Environments, Volume 1/2

[7] JM Spector, D Ifenthaler, TE Johnson, WC Savenye, MM Wang (eds.) (2015), Encyclopedia of educational technology (Sage, Thousand Oaks, CA)

[8] Korea Education and Research Information Service: Issues Analysis of the Learning Management System in Smart Education, RM 2012, vol. 18, pp. 11(2012).

[9] Boulanger, D., Seanosky, J., Kumar, V., Kinshuk, Panneerselvam, K., & Somasundaram, T. S. (2015). Smart Learning analytics. In G. Chen, V. Kumar, Kinshuk, R. Huang, & S. C. Kong (Eds.), Emerging issues in smart Learning (pp. 289–296). Springer Berlin Heidelberg. Retrieved from http://link.springer.com/chapter/10.1007/978-3-662-44188-6_39

[10] Li, B. P., Kong, S. C., & Chen, G. (2015). A study on the development of the smart classroom scale. In Emerging issues in smart learning (pp. 45–52). Heidelberg: Springer. Retrieved from http://link.springer.com/chapter/10.1007/978-3-662-44188-6_6

[11] Hwang, G.-J. (2014). Definition, framework and research issues of smart learning environments - a contextaware ubiquitous learning perspective. Smart Learning Environments, 1(1), 4. doi:10.1186/s40561-014-0004-5.

[12] Kumar, V. S., Kinshuk, Dr Clemens, C., & Harris, S. (2015). Causal Models and Big Data Learning Analytics. In Ubiquitous Learning Environments and Technologies (pp. 31–53). Heidelberg: Springer. Kumar, V. S., Kinshuk, D., Somasundaram, T. S., Boulanger, D., Seanosky, J., & Vilela, M. F. (2015b). Big data Learning analytics: A new perpsective. In Ubiquitous Learning Environments And Technologies (pp.139–158). Heidelberg, Germany: Springer.

[13] Kay, J. (2008). Life-long Learning, learner models and augmented cognition. In B. P. Woolf, E. Aïmeur, R.Nkambou, & S. Lajoie (Eds.), Intelligent Tutoring Systems (pp. 3–5). Berlin: Springer.

[14] Cathie Norris and Elliot Soloway(2014) Web 2.0 to Social 3.0: The Next Big Thing THE Journal

[15] Nonaka, I. and Takeuchi, H. (1995) The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation. Oxford University Press, New York.

[16] IMS Learning Design Specification http://www.imsglobal.org/learningdesign/index.htm

[17] Forging Online Education through FIRE http://ict-forge.eu/

[18] Future Internet Research and Experimentation (FIRE) https://www.ict-fire.eu/

[19] http://maps.smartsantander.eu

Organised by State Universityt of Library Studies and Information Technologies

United Nations
Educational, Scientific and
Cultural Organization

UNESCO Chair on ICT in Library Studies,
Education and Cultural Heritage,
State University of Library Studies
and Information Technologies (SULSIT), Bulgaria

Under the Patronage of the Bulgarian National Commission for UNESCO

and with the financial support of:

- the Erasmus+ Project 2014-1-BG01-KA203-001561
- Project with partial funding of scientific event sponsored by Decree № 3 of Ministry of Education and Science: PPFSE-2016-05

http://unesco.unibit.bg/

QED'16: Technology Advanced Quality Learning for ALL