# E-learning & Lifelong Learning

Scientific Editor Eugenia Smyrnova-Trybulska

Katowice – Cieszyn 2013

**E-learning & Lifelong Learning** 

University of Silesia in Katowice, Faculty of Ethnology and Sciences of Education in Cieszyn

### **E-learning & Lifelong Learning**

Monograph

**Scientific Editor** 

Eugenia Smyrnova-Trybulska

Katowice - Cieszyn 2013

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#### **INTRODUCTION**

In Saint Petersburg G20 Leaders' Declaration of September 6, 2013 we can read: "26. Policy reforms to support higher employment and facilitate job creation and better matching of skills with job opportunities are central in our growth strategies. We commit to take a broad-ranged action, tailored to national circumstances, to promote more and better jobs:...".. and further on in the text: "Invest in our people's skills, quality education and *lifelong learning programs* to give them skill portability and better prospects, to facilitate mobility and enhance employability. (G20 Leaders' Declaration, September 6, 2013, St Petersburg" (http://www.g20.utoronto.ca/ 2013/2013-0906-declaration.html).

The 'Europe 2020' strategy for smart, sustainable and inclusive growth calls for the development of knowledge, skills and competences for achieving economic growth and employment. The accompanying flagship initiatives 'Youth on the Move' and the 'Agenda for new skills and jobs' emphasise the need for more flexible learning pathways that can improve entry into and progression in the labour market, facilitate transitions between the phases of work and learning and promote the validation of non-formal and informal learning (Council Recommendation, 2012). In this context it is important to emphasise that not only formal education but also non-formal and informal education, based on e-learning, will be of crucial importance for lifelong learning, and so will the identification and analysis of contemporary solutions to priority questions regarding theoretical, methodological and practical aspects of e-learning.

The monograph "*E-learning & Lifelong Learning*" includes the best papers, prepared and presented by authors from eight European countries and from more than twenty-five universities during the scientific conference entitled "*Theoretical and Practical Aspects of Distance Learning*", subtitled: "*E-learning & Lifelong Learning*", which was held on 14-15.10.2013 at the Faculty of Ethnology and Sciences of Education in Cieszyn, University of Silesia in Katowice, Poland.

The speakers were from the University of Ostrava (Czech Republic), Extremadura University (Spain), Jagiellonian University (Poland), Warsaw University (Poland), Silesian University in Opava (Czech Republic), University of Silesia in Katowice (Poland), National Defence University (Poland), University of Defence in Brno (Czech Republic), Maria Curie-Skłodowska University in Lublin (Poland), The Graal Institute (Portugal), Lublin University of Technology (Poland), Kazimierz Wielki University in Bydgoszcz (Poland), Częstochowa University of Technology (Poland), Cracow Pedagogical University (Poland), Borys Grinchenko Kyiv University (Ukraine), Russian State Vocational Pedagogical University in Yekaterinburg (Russia), Centre for Innovation, Fryderyk Chopin University of Music in Warsaw (Poland), Nowy Sącz Business School – National-Louis University (Poland), Herzen State Pedagogical University (Russian Federation), Dragomanov National Pedagogical University (Ukraine), State Higher Vocational School in Krosno (Poland), Cardinal Stefan Wyszyński University (Poland), Lisbon

University (Portugal), University of Social Sciences and Humanities in Warsaw (Poland), Ternopol State University (Ukraine), Academy of Social Science in Słupsk (Poland), Cherkasy State University (Ukraine), Poznań University of Medical Sciences (Poland), University of Žilina (Slovak Republic), Adam Mickiewicz University in Poznań, Mieszko I College of Education and Administration in Poznań (Poland), Innsbruck University (Austria), Jesuit University of Philosophy and Education "Ignatianum" in Cracow (Poland) and other educational institutions.

The authors include well-known scholars, young researchers, academic lecturers with many-years' training and experience in the field of e-learning, PhD students, distance course designers, writers of multimedia teaching materials, designers of web-sites and educational sites.

I am convinced that the monograph will be an interesting and valuable publication, describing the theoretical, methodological and practical issues in the field of the use of e-learning for societal needs, offering proposals of solutions to certain important problems and showing the road to further work in this field, allowing for exchange of experiences of scholars from various universities from many European countries and other countries of the world.

This book includes a sequence of responses to a great deal of questions that have not been answered yet. The papers of the authors included in the monograph are an attempt at providing such answers. The aspects and problems discussed in the materials of the include the following:

- A new role and possibilities of using e-learning for lifelong learning (LLL);
- The place and role of distance learning in the education systems and lifelong learning in Visegrad group countries and other European countries;
- Teachers' and learners' competences in distance learning and computer science;
- A relation between building an information educational environment of the university (school) and forming lecturers' (teachers') ICT competences
- Efficient use of e-learning in improving the level of students' key competences;
- Pedagogical and methodical aspects of Cloud Computing;
- Distance learning of humanities as well as science and mathematics a differentiated approach;
- How to successfully use e-learning in the training of professionals in the knowledge society
- Formal, non-formal and informal distance education and LLL
- Psychological, social, ethical, cultural and legal aspects of distance learning;

- E-learning and social media for the disabled; the use of Internet technology and social media for people with limited abilities and special needs – theoretical and practical aspects of their use;
- Appropriate, efficient methods, forms and techniques in distance learning;
- Quality tools in E-learning and criteria for evaluation of distance courses;
- Educational strategies to enhance learners' motivation in e-learning, etc.

Publishing this monograph is a good example of expanding and strengthening <del>of</del> international cooperation. I am very grateful for valuable remarks and suggestions which contributed to the quality of the publication. Here I especially want to thank Andrzej Szczurek for his assistance in editing this publication. Also, I would like to say 'thank you' to the authors for the preparation and permission to publish their articles. I wish all readers a pleasant reading. Thank you.

Eugenia Smyrnova-Trybulska

## I. E-LEARNING AND LIFELONG LEARNING

# HOW SHOULD WE TEACH, IN THE SCHOOL OF THE FUTURE?

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Abstract:During a life time we across several stages of learning and teaching, if you want to be a good student you must: Learn how to learn; learn and learn. But if you want to be a teacher you must had more skills, like: Teach how to learn; Teach and teach; Teach how to teach. A student should start by learn how to learn, this means the methodology of learning, which facilitates to be a good student and much benefit of your learning effort. If we consider a constructivist approach, we must consider three phases in three different levels evolution: Defining roles and moulding; Coaching; Built your own knowledge with Support and scaffolding. But before all, we have to investigate, "How does a human being learns" and from that define a proper methodology and technology to teach. Now you can define a student's learning guide. In parallel we must as well define what should be the compulsive and recommended skills that a teacher must have to be a good teach for the "school of the future".

Keywords: e-Learning, teaching, new technologies, ICT, the school of the future

#### **1-E-EVOLUTION**

The technological evolution during the last 7 decades evolve from one "room computer" (Mark I 1943) weighting several tons into a small tiny laptop, weighting less than one kilo and thousand times more powerful than his "grand, grandfather".

This technological revolution was followed by an enormous change in methodologies and didactic tools in a view to their implementation.

In two decades we build up information, communication, interactive and mobile society we are living today connecting civilizations in real time across the planet.

This results in an enormous sociologic impact in all scientific areas, as well in education processes.

The social profile of our students has also changed. Students average age has increased, because of the: "4 years of university basic education are just an introduction to 40 years of long life training" Lima J. (2004).

There is no doubt that students today are building their own knowledge, demanding more interactivity, more multimedia contents, they are more Web dependent, more surface learners, and wiling for more mobility, better didactic communication in presence and distance learning.

This is because, they are digital constructivist learners, multi intelligent, (Gardner and Flaming 1986), emotional behaviorist learners (Daniel Goleman 1999), interactive learners (Alcino Silva 2001) and they are collaborative social virtual learners (George Siemens 2005).

This results into a new way of teaching and learning, with new technologies and new methodologies, that we can call "the school of the future".

Although teachers are better and better prepared in their scientific area and a large amount of investment has been made in the last decades in new technologies and methodologies, teacher's skills are short in fulfilling all education requirements.

The questions today are:

- Are we, teachers, prepared to offer it?
- Do we have the right skills?
- What are the best technologic tools, and the best methodologies to do it?
- Is e-learning a solution? Or just learning? (To be used in both presence and virtual environments).

Enormous amount of training, research and reflexions has been done to answer these questions.

#### 2 - HOW DOES A HUMAN BEING LEARN

Human beings have different learning styles, are multi modal learners, asking for more multimedia contents and distance learning. Let us identify these profiles.

#### 2.1 - Characterization of behavioral profiles and learning styles

Each person has different characteristics and behavioral profiles and requires careful classification in order to find the most suitable learning process.

But also their own individual learning style profile varies during, the physiological life cycle, and according to the moment of the learning cycle.

Sarah Corneluius (2001), identifies two very important aspects to take into account: a constructivist approach and personalized education, which consists in the fact that this should be the perspective of the student, "just in time" and "just for me".

This assumes important job identification by the tutor as to the student's profile and its behavioral attitude in terms of typifying profiles and how they learn, and then to be able to set up a teaching approach in terms of learning objects, strategy, educational contents and techniques.

One of the ways through which any student can be identified is by their "learning style".

Keefe features "learning style" as follows:

... "Feature cognitive, emotional and psychological behavior, which serves as indicator for the stable learner, learns, interacts and reacts in the learning environment" ...

Honey and Mumford (1985) stated that ... "the learning style affects how the learner receives and assimilates information" ..

These aspects are therefore extremely important as work elements for the implementation of the tutor's work in the teaching process and hence the optimization of individual learning process.

Work is needed to identify important learning profiles of different students, especially when working with relatively large and heterogeneous groups (class) where a responsive educational model to fill out a greatest common divisor of the group learning.

There have been several attempts to classify learning styles and have been pointed out several criteria and grids.

The most common classifications have been the following:

- Active, reflective, experimental and theoretical;
- Superficial and deep;
- Visual, auditory;
- Tactile and kinetic.

#### 2.2-Our students are digital learners

- Sociological and behavioral changes of students.

Today in the twenty-first century, the dependence of television, computer games and communications predominantly audio visual meant that our students are eminently "digital learners".

The lack of interest and motivation of our classes, has been pointed as one of the factors of school failure.

- More than 10,000hours playing "videogames";

(inter active gaming, media scope, June1996);

- Over 10,000hours talking on cell phones;

(Prensky2001, Digital Natives, Digital Immigrants);

- Approximately 20,000 hours seeing TV;

(Prensky2001, Digital Natives, Digital Immigrants);

- Children and adolescents spend more than 2.75hours / week on the PC;

(Institute of Social research, 2004);

- In 70% of countries almost all children from 4to 6 years have used PCs;

(KaiserFamilyfundation2003);

- Every day, 68% of children over 2 years spend more than 2 hours a day with digital games;

(Kaiser Family Foundation2003).

Our students are not motivated because they consider that what is taught in school is of little use for their future success:

- 21% of students completing the course consider it to be interesting;
- Only 39% consider that that school work may have some interest for their future success in life.

The failure of the current model of school is reflected in the fact that: 79% of students consider that the courses are "not interesting" and that 61% faced "school work with little or no concern for their future practical life."

However, these data refer only to the opinions of students completing the courses, if we consider also the students who dropped out, the results would be far more compelling.

#### 2.3 - Mapping the brain and multi-channel learning process

Studies in the field of neurophysiology carried out in the late 90s and in this decade, such as the ones performed by Antonio Damasio (1995) and Joan Stiles (2006), consolidated and completed studies started in the beginning of last century on the brain areas associated with each vital activity such as perception, understanding, vision, speech, hearing, emotions or thoughts, by Brodiman (1909). These studies complete the cataloging and mapping of the human brain and its implications in the process of acquiring knowledge, introducing new factors in the rationality learning theory.



Figure1. – Brain Maping

#### Source: A. Reis

The brain understands the phenomena that surround us in different areas of perception; this means that when the communication process is received in the working memory and performed it is directed through different areas of the brain and through different channels that facilitate the learning process. After as meta cognition process, it takes place the creation of synapses, which provide cross-links neurons and the optimization process of information available creates conditions to enhance the activities and developing the reflective target cognition and to memorize it in long term memory.

Joan Stiles (2006) states that the human brain has about 100 billion neurons, which can be developed over 60,000 million synapsis.

This approach expands and enhances the process of didactic communication, thus giving greater weight to each of the instruments it incorporates and requiring a teaching effort to improving the mastery of various techniques for exercising their profession in an effective and responsible manner.

Corneluius in Fleming (2001) concludes from responses to a survey on the model VARK (visual, audio, read/write, kinetic), cited above, that about 60% of students take multiple and evolving capacities, as the style of learning.

Which leads McKenzie (2000) to conclude, commenting Creanor, quoted in Corneluius (2001): ... "in theory presenting content synchronously in different formats simultaneously, we possibly create conditions for our students understand and memorize better" ...

But teaching at school level (according to the analysis in 2010) continues to rely largely on oral transmission almost exclusively.

If we take into account that some classical studies, but with some reservations and relative values (Flores 2009) point to different levels of information retention depending on how it is transmitted to us, ie, we retain:

10% of what we read.

20% of what we hear.

20% of what we see.

50% of what we see and hear simultaneously.

90% of what we say and do.

We can conclude that about 80% of which is exposed only by the verbal form, by agents of education is lost.

It is therefore important and urgent, to implement the extensive use of multimedia tools in teaching, if we want effectively improve the transfer of knowledge and consequently its quality.

The fundamental conclusion is that the didactic communication process should be enriched by means of multi-channel communication, with the aim of facilitating the process of acquisition of knowledge by the student and better and more efficient teaching.

#### 2.4 - The importance of the image in knowledge transfer

The image has been an important tool in knowledge transfer. Antonio Damasio (1995) expressed it by:

... "No one will deny that the thought certainly includes words and symbols. But what does not account for this statement is the fact that both the words and other symbols are based on topographically organized representations and are themselves images "...

But if we follow an inductive process completion will be no different.

Since the earliest times and in all cultures that man has used the image as a tool for knowledge transfer.

Both in terms of prehistoric cave paintings, Persian cultures, Egyptian, Chinese, Japanese, Indian, Inca, Mayan or Aztec, as in antiquity, middle ages and renaissance.

But it is with the advent of multimedia technologies and domain that the image takes on a dominant role and becomes key in the process of transferring information and knowledge.

Today television habits lead to almost everybody in one way or another absorb important part of the information through media.



Figure2. - Pictographic communication in different cultures and times

#### Source: A. Reis

Labour (2000) concluded from their studies that about 65% of the students are "visual learners."

The Internet is a means of excellence for delivering content, with riche pictures, in addition to text or still image with sound or films

Gómez (2003) states that ... "the Internet provides a bridge between school culture and audiovisual culture outside" ...

It should be noted that however that it is generally agreed that the image and multimedia do not replace other forms of communication, such as writing, which is not alternative but complementary.

It is therefore essential to integrate the processes of image presentation, in content for all levels of education, whether it is expressed in a static or animated form, vulgar films, so that the learning process is facilitated and optimized.

#### 2.5 - The interactive process, reflective and iterative learning

Alcino Silva (2001), a researcher in the field of neuro-physiology (LA. University - USA) presents the results of its investigation to characterize the learning process of the human brain, in view of this scientific area.

From his work it can be concluded that interactive activities and reflection results ahormonal process changing that determine a memorization on a permanent basis in the human brain.

In an easy way we can say that the human being, receives information in the "working memory" in a passive, unstructured or organized form. When in a certain moment that there is some phenomenon, a "Clik" that alters the mental state and

consequent causes hormone production (testosterone, endorphins oxiocitins and others) and start to memorize in short term memory.



#### Figure 3. – How do we learn from the neuro physiologic point of view – step one – working memory

#### Source: A. Reis

In the next phase, the receiver performs a very short reflexive action, that leads to reject and erase, or if it is considered important, the received information held in working memory (or short-term), will be integrated through a meta cognition process in long term memory, using a logical or emotional process.

If the first part of the process is a quite fast one, the meta cognitive process, may take a long time of reflection.



Figure 4. – How do we learn from the neuro physiologic point of view – step two – long term memory

Source: A. Reis

What is really behind this approach again in relation to cataloging classical "traditional theory (behavioristic)" and "current theory (constructive)," which replaces one another, is that both theories coexist. They are only separated by the state of knowledge in which the learner is whether this state of knowledge is related to the point of the life cycle in which it is either the point of the state of knowledge that is in relation to a particular subject or learning process.

#### **3 - THE LEARNING ENVIRONMENTS**

#### **3.1-** The Distance Learning stages

We can find references to distance learning since the  $18^{th}$ century (Verduin& Clark · 1991), although in practice it was not used regularly up until the mid  $20^{th}$ century in the USA and some European countries.

The Second World War forced an important increase in distance learning, because many young people incorporated in the war needed to go to the front line and simultaneously many of them have to be replaced in their civil jobs with no trainers or tutors available.

On the other hand, when the war was finished all the young people had to be integrated back in professional civil activities.

It is in this scenario that since the mid-forties Skinner starts to talk about the "Teaching machine", but in that period he did not realised what type of "Pandora box" he was opening.

Skinner introduced in 1954, CAI (*Computer Assisted Instruction*) in his classic article ('The science of learning and the art of teaching") he summarizes the basics about "The teaching machine". The teaching machine and the programmed texts, are the previous format of CBI (computer based instruction) turned into reality later with the PCs.

http://www.virtualeduca.info/ponencias2009/381/Conductismo,%20Cognitivismo%20y%20Dise%F10%20Instruccional.pdf

For the development of educational programs it was necessary the analysis of tasks and objectives. In 1956 B. Bloom published the conclusions of his research on: "The taxonomy of educational objectives". Distance learning evolved in different stages (Moore and Kearsley 1996) following the development of computers, multimedia and Internet. On the other hand, technologies evolved gradually in number, complexity and potential, offering new models of distance teaching and learning (Chute et al. 1999).

1 First distance learning stage (-» 1970): courses contents were totally delivered by regular mail

The pedagogic approach followed for this stage and the two subsequent stages were totally behaviorist. In this stage, we saw the first training courses presented in the radio (1930) and television (1954).

#### 2. Second stage (1970 -1980): Open Universities

Despite what has been pointed out by Skinner and Bloom in the fifties, it was in the seventies that the theoretical bases for distance learning flourished, particularly as the result of the "World Conference for Distance Learning", coordinated by Wedemeyer 1972.

In 1969 the "UK Open University" was founded and Bloom was one of the consulting advisers of this project. "UK Open University" is known as one of the most relevant projects in this area and a model for many other experiences that took place all over the world during the seventies and eighties (Daniel 1996).

Michael Moore (1973), suggested that some resources should be allocated to defining the research areas, identify different types of distance learning and to build up theoretical methods.

#### 3 Third stage (1980 - 1990): Video cassettes and TV

The rise of video players, satellite and cable communications enhanced the importance of TV and video communication in distance learning. The audio and image quality of the contents was very fair and video players were offering the possibility of students to attend lessons "anytime, anywhere" and how many times learner needed.

Since 1985, different sets of courses were offered with a remarkable success.

#### 4 Forth stage (1990 - 2000): Computers, multimedia, interactivity, e-Learning

Technological evolution of digital equipment and software showed new possibilities of interactivity and improved the quality of distance learning.

CD-ROMs and Internet (1990) were two important innovative tools, offering flexible learning, allowing anyone to use virtual learning environments irrespective of the place or time-zone where they are. In addition, new communication systems based on Internet, started to offer the potential of interaction among students, teachers and specialists across the world.

This period marks the rising of the system - the beginning of multimedia contents production, communication and distribution using LMS.

One of the most important aspects is the evidence of a need for new methodologies in parallel with new technologies.

Some proposals in this area have been presented since the early nineties:

a) Moore (1993) considered the "curriculum" as a "structural" area and the constructivist "dialog" as a need;

b) The "student autonomy", was highlighted as important and called "transactional distance theory", from Dewey "transaction" concept, which was later developed by Boyd and Apps.

There is a large consensus about the definition of distance learning. The focus is the physical separation between students and the teacher during the learning process (William, Paprock, Covington 1999).

One of the most coated distance learning definitions produced by Moore and Kearsley (1996) states: in the courses the teaching and learning process is running in separated environments and it is necessary special techniques over the curriculum formulation, teaching, communication, organization and administration. However, it is also important to point out that it is based on new methodologies that the learning process takes place and becomes effective.

A new vision for using more interactivity, multimedia, graphic animation, audio, and video (steam video 1997) hypertext, and communication over email, chat and "focus groups", was the dream of many authors and course coordinators in that period, but still difficult to implement.

Students started to be seen as active partners, using different technologies.

In fact the use of this format was very limited until the mid of the first decade of the 21<sup>st</sup> century, mainly due to short bandwidth available and its high cost. Also, the technologies available were being used without being supported by adequate new methodologies, which might have turned distance learning activities into "technological noise".

There is a final question: What is e-learning today?

#### **3.2- Online Learning Environment**

Back in 2000 when we talked about e-learning we were certainly talking about distance learning.

However, when we talk about online learning today, are we exclusively talking about distance learning? Not necessarily!

Today we can be talking about distance learning supported in presence activities or presence learning supported in distance / online activities.

In fact, we are in the presence of an emerging concept in constant evolution.

The increasing use of online tools in presence teaching makes online tutoring as a daily support tool with excellent results to improve the learning quality.

What are the changes that justify that?

We could see that the nineties were a break-even period for a qualitative change in distance learning. Important technological evolutions, software development and communication facilities occurred during this period, particularly, the development of very fast CPU's, allowing video and audio editing. Hard discs, with very high

capacity and rotations above 7.200 rpm, able to capture video, "stream video" available after 1997 diffused over the Internet (1990) / WWW (1991), video projectors, etc.

Software to produce audio and video contents and presentations became available.

However, only after Internet was available with sufficient bandwidth and at an affordable price (in the first decade of  $21^{st}$  century) it was possible to start using it for education purposes. Video conference tools were available in acceptable quality and prices for education 1x1 or "many to many" in the format of virtual classrooms, after the year 2000. On the other hand, because of its high cost, only after 2004 open source LMS platforms used at all education levels became available.

#### 3.3 - e-Learning evolution

World education evolved from kindergarten to postgraduate degrees or to long life learning.

The reasons pointed out for this are the political pressure over school results, the imaginary usage of ICTs, the challenges the Bologna methodology brought, and the common use of computers, social networks and 3D environments.

The learning theories of the digital era emphasize the importance of asynchronous interactivity (related with Web 2.0 (Downs S. 2004) and (O'Reilly 2005) as well as synchronous interactivity, collaborative work and the inducing connectivism (Siemens G. 2005). Later, this is accepted as an evolution in the learning processes based on technologies, and the mobility in the collaborative and informal learning.

Daniel Goleman (1999), in his "Emotional Intelligence Theory" suggests the use of pedagogic games and other emotional intelligence activities to increase the learning quality.

This emotional oriented approach opens an opportunity to use 3D environments as eligible and valid tools for the education proposes.

From our experience in using Second Life and Active Worlds, we consider it to have good potential, but some didactic limitations, particularly in MUVE platforms when used in some education environments.

According to the needs of our student's profile, teachers should update their technological and methodological skills. This requires permanent training in areas like:

- new collaborative learning methodologies;
- online tutoring, on the use of virtual classrooms, video conference tools and virtual group work;
- tools, to produce contents in multimedia format, pedagogic games, the use of interactive synchronous and asynchronous tools;

- know how to use online platforms for managing contents (LMS) and other supporting interactive animations like 3D and MUVES;
- Continuous formative assessment;

Rosenberg (2001), emphasized that teaching today means different forms and formats, like presence teaching, online teaching, virtual teaching, blended teaching and other.

According to García et al - (2007), Bernárdez - (2007), Bernal - (2007), there is no sense in trying to develop opposite terminology and make the "black and white game". It is much more important to integrate the differences and complementary but mainly to improve teacher's skills.

An interesting study ordered by the US Government about online education, important rules and methodologies about it are important (Means, B. Toyama, Y. Murphy, R. Bakia, M. Jones, K. May 2009).

According to Means B. (2009), "online learning" is "learning totally or partially using Internet. This definition excludes: printable documents, the use of TV or radio".

This definition is not consensual. Some other authors use a broader definition accepting a large use of different electronic equipment - more or less what is usually called today as "online learning" or "e-learning".

The e-learning definition has changed over the years and included different contents, but always expressed a relation between learning and the use of computers.

The first used names were CBI (*Computer-Based Instruction*), CBT (*Computer-Based Training*) or just CBL (*Computer-Based Learning*).

During the nineties e-Learning was referred as distance learning.

In 2001 Rosenberg, introduced a reflection about the separation between distance learning and e-learning, saying: "e-learning is one format of distance learning, but distance learning might not necessarily mean e-learning" ...

Rosenberg, wanted to "separate waters": on one side, distance learning supported by documents sent by post or other traditional means - not being what we understand by e-learning today; and on the other side, teaching and learning supported by electronic equipment and tools.

Today there is the consensus that e-learning incorporates online tools and techniques, with contents distributed in multi modal format (printable, videos, audios documents etc.) using interactivity in asynchronous or synchronous tools using virtual classrooms or in presence or distance teaching.

In this regard, some authors says: "the revolution introduced by e-learning, lead that even in presence classrooms, learning will never be as it was in the nineties".

As such, in the beginning of the 21st century e-learning evolved into a blended format: comprising presence and distance learning broadly called b-learning.

We can say that this was the end of distance learning in its pure format. For long duration courses, from a pedagogical point of view, it is convenient that learning is completed in a mixed format by synchronous activities: presence and distance format.

But in a short period, with technological improvement, particularly over increased bandwidth availability, communication and video conference software and better teaching skills, the possibility of using virtual classrooms and synchronous activities can arise as a full alternative to presence learning.

What we have today are contents distributed asynchronously and tutoring in presence or virtual format.

This approach is being done according to Web 2.0 recommendations.

#### 3.4 - E-Learning stages - from e-learning 1.0 to e-learning 3.0

Today the focus of the debate is: "e-learning stages".

During the last decade, the concept of e-learning changed and evolved. It can be typified in three different phases, which can be distinguished by: the presence of interactivity or not; the existence or not of multimedia contents; and the existence of synchronous and asynchronous online support.

The evolution of technology, pedagogic methodology and teachers skills allow us today to use all the above mentioned approaches.

This systematization is a result of our research and was presented and debated for the first time in 2008 in Argentina – Cordoba Learning International Conference and in November 2008 Russia at Izhevsk University International Conference

We decided to promote collaborative research involving several colleagues (Florentino Blázquez, Sixto Cubo, Xabier Basogain and K. Olabe) from that we have presented a communication at London University in World Mobile Symposium – March 2009.

This subject has been submitted to several debates and international conferences such as.

#### First e-learning Stage 2000 -

**e-learning** (1.0) – Courses were structured in a self-learning format and only lectured virtually (distance learning). Contents were distributed in pdf or word prints and no interactivity existed. At the end of the course, students were normally subject to final presence examinations.

Very early, students and teachers realized the limitations of this approach and a mixed solution of presence and distance learning was recommended - usually called "blended learning – b-learning".

#### Second e-learning Stage (2004)

**e-learning 2.0** - In 2004 Stephan Downs and O'Reilly started presenting their ideas about Web 2.0.

Stephan and O'Reilly, called for a more dynamic WEB and stressed the importance of interactivity with important repercussions in education environment.

A major important topic was the interactivity and multimedia content in asynchronous format. Teacher – student; student – contents; student – student. The tools available for synchronous activities like virtual classrooms or video conference were few and very expensive and they required quite a high bandwidth.

The content was mainly distributed using the following tools: forums, chats, wikis, blog all of them using asynchronous format, integrated or not in LMS (Stephen Downs 2005, 2007, 2009 y Tim O'Reilly 2005).

#### Third e-learning Stage (2006 -»)

**e-Learning 3.0** - The technologic evolution, mainly related to communication tools it was a relevant factor for the third stages. Video conference and virtual classroom software are offered at much lower prices and require much less bandwidth. ISP suppliers offer sizeable bandwidth at fair prices. Simultaneously, LMS platforms are being offered at "open source", like Moodle, Joomla among others. From a technological point of view distance learning requirements are now fulfilled in good conditions in earlier formats. This means that there are available asynchronous distribution and a need of communications tools for synchronous online tutoring.

Now, we are facing a new quality challenge on distance learning. It doesn't matter if it is called CBL, ICT, e-learning, online learning or any other thing, technical tools are available to work with quality at any education level.

Everyday better and better tools are being offered to facilitate the teacher's job and the students' learning. But, learning and teaching tools require more skills from teachers and students and new methodologies.

In 2006 Stephan Downes, presents a new view over a web 3.0. This view includes that the Web should be more effective over browsing and searching in terms of semantic and obtained results, although, the relation between his "future view" and education science was short.

In 2006 we could again say that we were facing a new phase of e-learning.

e-Learning 3.0, which emerged from "connectivism" based in the George Siemens approach, which includes mobility, multimedia contents and online synchronous interactivity.



#### Figure 5. – e-Learning generations

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Source: A. Reis
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The main aspects used in this environment are:

- The use of new technologies supported in new methodologies;
- The use of LMS to distribute asynchronously contents and manage courses, in distance and presence learning;
- Online synchronous tutoring support, using audio, video, white boards and other tools in virtual classrooms;
- Continuous formative evaluation supported by online activities;
- The Blend learning concept has changed from a mix of presence and distance learning into asynchronous and synchronous activities, whether if in presence or virtual format using virtual classrooms;

The main synchronous virtual tools used were: virtual classrooms, e-round table, Webcast, video diffusion, e-workshop, conference call.

Hart (2008) identifies three stages of e-learning and associates them with Web 1.0, Web 2.0 and Web 3.0. In fact, he could establish a relation between Web phases and e-learning phases.

Basogain X. (2009) reports that: "In (Reis et al, 2009) the formulation of elearning 3.0 by Reis, is different from Downs, because he introduces a pedagogic environment and the new e-learning stages includes several didactic tools also used in presence and distance learning" The concept of b-learning has also evolved from face to face and virtual, to asynchronous learning platform supported in as (Moodle, Blackboard and others) and synchronous formats in their virtual or presence. All, strongly supported by multimedia contents, interactivity in online tutoring and synchronous virtual classroom and formative assessment and reported in communications in international conferences.

Also, mobile learning is seen today more as a complementary tool rather than an alternative tool. The results obtained from our research on this subject were presented at 3rd WLE Mobile Learning Symposium, Institute of Education Sciences at the University of London.

#### Table 1.

	Distribu-	b-learning	Interactivity		b-	Multi-
	Asyn- chronous Contents	presence / distance	Asyn- chronous	Synchro- nous	Learning Asyn- chronous/ Syn- chronous	media
e-Learning 1.0	Y	Ν	N	N	N	Ν
e-Learning 2.0	Y	Y	Y	N	N	Y
e-Learning 3.0	Y	Y	Y	Y	Y	Y

Summarizing e-learning stages

A relevant aspect that should be pointed out is that the change from phase one into the next did not eliminate the didactics of the previous, it only introduced new didactic tools, new methodologies and build a richer learning environment.

The focus is on questioning much more than just technologies, it is in introducing new methodologies and new skills to frame the educational process, to respond to a set of new needs of our students in online learning.

The solution includes a set of virtual classrooms, techniques and processes that characterize what we can call "new, ICT".

#### 4 - HOW SHOULD WE TEACH

Besides of being an expert in a specific scientific area a teacher or a trainer should have pedagogic and didactic complementary skills.

Different skills are necessary to enable teachers to be prepared to be a "teacher of the school of the future".

- Presenting contents in a structured format with adequate semantics adjustments to the used format
- **Didactic communication** 
  - □ Written communication
  - □ Narration
  - □ Visual multimedia presentation / slide show
  - Non-verbal communication / gesture / body posture / facial expression
  - □ Specific syntax to each element of lexical communication
- Tutoring didactic orientation, reflectivity and interactivity
- Formative continuous assessment
- Know-how to use ICTs and didactic tools in education process

All these different areas are a must to perform as a good facilitator and using the necessary good practices.

## **5 - TSSF – TEACHERS' SKILLS FOR THE SCHOOL OF THE FUTURE**

In 2011we began a series of debates entitled "Teacher Competencies for the XXI century". This round of discussions was held in e-roundtables, involving experts in the teaching of European origin, North American and Canadian and Latin America and Brazil, being the President of the cycle of debates Prof. Peter Veiga (Vice-Rector of the University of Lisbon), the Chairman of the Scientific Comity Prof. George Siemens (teacher coordinator of Athabasca University-Canada) and António Reis assumed the coordination and implementation of the research project. The discussions were held in three languages, Portuguese, Spanish and English, during a period of eleven months covering the following topics:

- Basics of computer use, electronic media and the Internet
- New methodologies and techniques of production and publishing of multimedia content
- Didactic Communication
- Tutoring Online
- Formative evaluation methodologies and tools

- General on new methodologies
- Placement in different levels of education
- Placement in different geographical environments and cultural education

Full details on the project can be seen on the Web sites: http://olcw.thegraal.net/TSSF/index.html

On each topic there was a debate held in the virtual environment and in-roundtable in each of the languages of the project, followed by discussion forums, publishing online survey, summary and conclusions of the quantitative and qualitative data. The videos of the sessions, and feedback from forums and surveys can be viewed at:

http://thegraal.ccems.pt/course/view.php?id=90

At the end we present the general conclusions of the investigation in an international conference at the Udmurt University's in Russia.

Final conclusions summary.

1. About the future: The future is now. It will be today, tomorrow, next year, in 5 years or more, depending on each one, but it will be;

2. About different skills in different environments, we can say that Internet made the world flat and globalized. To give the same opportunities to our sons, daughters, and grandchildren we must offer them the necessary toolbox for a global competition;

3. The main reason for the changing is: Our students have changed! Not only the technologies and the methodologies;

4. Everything is changing and speed factor is incising, more and more each day;

5. Besides of being experts in one or more scientific areas, we teachers and trainers need to get a pedagogic and didactic toolbox of new skills.

- Obligatory methodological and technologic skills;

- Recommended skills.

#### New skills are:

6. New methodologies on General environment of theories and methodologies of teaching and learning; Self learning approaches on techniques; Learning styles and teaching process; Objectives and teaching taxonomies; Teaching methodologies; Presence pedagogical techniques versus distance techniques; etc.

7. Skills on didactic communication in multi modal communication, using pictographic language, use properly the voice, none verbal communication and adequate semantic for each circumstances.

8. Skills on producing and using pedagogic contents, like how to make Didactic videos, pedagogic games, blogs, web quests, wikis, The web 2.0 tools, etc.

9. Skills on online tutoring synchronous and asynchronous. The domain of technologies and methodologies of using LMS and virtual classrooms.

10. Skills on formative evaluation and assessment. The collaborative learning approach in presence or remotes environments and use evaluation as a learning too.

11. The use of collaborative learning environments, connectivism and social nets works for learning.

#### REFERENCES

- Anderson, L., W., & Krathwohl, (Eds.), 2001: A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. New York: Longman
- Blázquez, F., 2004: Organización de Espacios Virtuales de enseñanza. Actasdel VIII Congreso Interuniversitario de Organización de Instituciones Educativas, Sevilla: Secretariado de Publicaciones.
- Blázquez, F. y Alonso, L., 2012: Apuntes para la formación del docente de elearning. Enseñanza. Revista Interuniversitaria de Didáctica
- Briggs, K., Myers, I., 1962: Myers-Briggs Type Indicator, available at http://en.wikipedia.org/wiki/Myers-Briggs\_Type\_Indicator (Accessed on 22 October 2008)
- Clarke, W. 2000:Subject: none. Discussion Room: OTiS Best Practice for Effective Tutoring available at http://vls.scotcit.ac.uk/ (Accessed on 12 February 2001)
- Cornelius, S., 2001: *Learning Online: Models and Styles*. available at http://otis.scotcit.ac.uk/onlinebook/otis-t1.htm (Accessed on 10 May 2004)
- Cornell, R., e Martin, B., L., 1997: The Role 01 Motivation in Web-Based Instruction. In: KHAN, Badrul, H. (1997).Web-Based Instruction. University 01 Central Florida: Educational Technology Publications.
- Creanor, D., 2000: *Subject: Interactivity commenting on Muirhead's case study*. available at http://otis.scotcit.ac.uk/onlinebook/otis-t2.htm (Accessed on 10 October 2004)
- Damasio, A., 1995: *Descartes' error, emotion, reason and human brain*, Publicações Europa America, Portugal
- Downes, S., 2005: *E-Learning 2.0*, available at http://www.downes.ca/post/31741 (Accessed on 8 December 2007)

- Downes, S., 2007: *E-Learning 2.0 In Development*, available at http://www.slideshare.net/Downes/elearning-20-in-development (Accessed on 10 January 2008)
- Downes, S., 2007: *E-learning* 2.0, available at http://www.elearnmag.org/ subpage.cfm?section=articles&article=29-1 (Accessed on 10 January 2008)
- Downes, S., 2007: *Web 3.0 and Learning*, available at http://www.downes.ca/cgibin/page.cgi?post=36700 (Accessed on 10 December 2007)
- Downes, S., 2008: *Options and Opportunities*, available at http://www.ciconline.org/c/document\_library/get\_file?folderId=109&name= THSpring08OptionsandOpportunities.pdf (Accessed on 12 September 2008)
- Edwards, J., 2001: *Multiple intelligences and theories*, available at http://www.firn.edu/~face/about/dec95/mult\_int.html (Accessed on 10 October 2004)
- Fleming, N., 2002: VARK and active learning, available at http://www.active-learning-site.com/vark.htm (Accessed on 21 March 2004)
- Gardner, H., 1983: Frames of mind: the theory of multiple intelligences. Basic Books.
- Goleman, D., 1999: *Trabalhar com inteligência emocional*, Lisboa, Ed. Temas e-Debates
- Labour, M., 2000: Subject: "Learning styles" what's in a name Discussion Room: OTiS – Tutor and Learner Styles (4) available at http://otis.scotcit.ac.uk/e-book (Accessed on 12 February 2001)
- Lima, J., Capitão, Z., 2003: E-learning e e-conteúdos. Porto: Centro Atlântico
- Masie, E., 2001: An E-Learning Journey. In ROSENBERG, Marc J. e-Learning: Strategies for Delivering Knowledge in lhe Digital Age. The Masie Cantar: McGraw-Hill.
- McKenzie, J., 2000: Subject: Multi Skilling. Discussion Room: OTiS Tutor Roles (2), available at http://vls.scotcit.ac.uk/ (Accessed on 12 March 2001)
- McKenzie, J., 2000: Subject: none. Discussion Room: OTiS Tutor and Learner Styles (4), available at http://otis.scotcit.ac.uk/e-book (Accessed on 12 March 2001)
- Merrill, D., M., 2000: Does Your Instruction Rate 5 Stars. New Zealand, International Workshop on Advanced Learning Technologies: IEEE Learning Technology Task Force, available at http://lttf.ieee.org/iwalt2000/ (Accessed on 25 January 2005)
- O'Reilly, T., 2005: What Is web 2.0: Design Patterns and Business Models for the Next Generation of Software, available at http://www.oreillynet.com/

pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html (Accessed on 28 August 2008)

- Reis A., 2010x: *Ciclo de debates sobre "As competências dos professores para a escola do Futuro"*, available at http://olcw.thegraal.net/TSSF/index.html (Accessed on 10 December 2011)
- Reis A., 2011ah: Ethical Issues social dilemmas in knowledge management, "From Connectivism to Ethicism", editor Premier Reference Source – USA NY, ISBN 9781 61520 8734 6
- Reis A. (Director), 2011ag: Presentación conclusiones de la investigación y Ciclo de debates realizados sobre "Teacher's skills for the school of the future", International Scientific Conference "Theoretical and Practical Aspects in Distance Learning", University of Silesia in Katowice, October 2011, Poland, Video available at http://olcw.thegraal.net/TSSF/final\_conclusions\_uk.htm (Accessed on 10 December 2011)
- Reis A. (Director), 2011af: Presentación conclusiones de la investigación y Ciclo de debates realizados sobre "Teacher's skills for the school of the future", conferencia internacional de la universidad de Izhevesk, Russia, Video available at http://olcw.thegraal.net/TSSF/Presenting\_at\_izhevsk.htm (Accessed on 10 December 2011)
- Reis A. Didactic videos Channel available at http://youtube.com/user/antoniodreis (Accessed on 1 September 2013)
- Reis A. Public blogs available at http://Areis-blogs.blogspot.pt (Accessed on 1 September 2013)
- Reis A. X. Basogain, M. Olabe, K. Espinosa, Sixto Cubo, Florentino Blázquez y, P. Pinto, 2009i: Sesiones online con grupos reducidos: tutoría y trabajo colaborativo. III Jornadas de Intercambio de Experiencias de Moodle, Moodle Moot Euskadi'2009. 15, May 2009, Bilbao, Spain. ISBN: 978-84-692-6845-2 DL: BI 2851-09 X.
- Reis A., 2010t: *E-learning the Evolution* In: *Use of E-learning in the Training of Professionals in the Knowledge Society* Monograph Sc. Ed. Smyrnova-Trybulska, University of Silesia, Cieszyn, pp.13-32 ISBN 9788360071304
- Reis A., (Director), 20090: *III Jornadas sobre Realidad Virtual y Entornos Virtuales*, JOREVIR'2009. Septiembre 2009, Barcelona, Universidad Pompeu Febra, available at http://thegraal.ccems.pt/file.php/51/jorevir09/jorevir09.html (Accessed on 10 December 2011)
- Reis A., (Director), 2009j: Creative Learning Conference, "New skills for new *jobs*" video available at http://olcw.thegraal.net/clc091016-01/clc091016.html (Accessed on 10 December 2011)
- Reis A., (Director), 2009p: Sobre el uso de entornos de aprendizaje 3D (SecondLife y Active Worlds), Video available at http://olcw.thegraal.net/SL/SL\_asVLE /play\_list.htm (Accessed on 10 December 2011)
- Reis A., (Director), 2010q: *Debate online sobre competencias de los profesores*, Video available at https://admin.emea.acrobat.com/\_a850382933/p80385830/ (Accessed on 10 December 2011)
- Reis A., (Director), 2010s: Presentación en Universidad de Rouen sobre uso de aulas virtuales para enseñanza de sordos, Video available at http://olcw.thegraal.net/diversos/rouen-100114/rouen-100114.html (Accessed on 10 December 2011)
- Reis A., (Director), (2010u): *El futuro del e-learning en la Universidad*, Video available at http://www.youtube.com/watch?v=f7w5Vm23O5U (Accessed on 10 December 2011)
- Reis A., Basogain X. (2009f): Investigação realizada sobre o uso de SL Second Life e Active Worlds como ambientes virtuais de aprendizagem, available at http://olcw.thegraal.net/SL/SL\_asVLE/play\_list.htm
- Reis A., Basogain X., (Directores), (2010v): *Trabajo en laboratorio virtual Universidad de País Vasco, con alumna sorda y un intérprete de lengua gestual*, Video available at http://uex.emea.acrobat.com/p17334634/ (Accessed on 10 December 2011)
- Reis A., Basogain X., Blázquez F., Cubo, S. Olabe M., 2009g: To be or not to be M-learning (that it is the Question), 3rd WLE Mobile Learning Symposium, Mobile Learning Cultures across Education, Work and Leisure, WLE Centre, IOE London, UK, 27 March 2009, ISSN 1753-3385 Book of abstracts, pp. 75-80 (pdf)
- Reis A., Basogain, X. M. Olabe, K. Espinosa, 2009e: Supporting the Education with 3D environments and MUVEs. INTERACCIÓN 2009. X Congreso Internacional de Persona-Ordenador. III Jornadas sobre Realidad Virtual y Entornos Virtuales, JOREVIR'2009. Septiembre 2009, Barcelona, Spain. ISBN: 13:978-84-692-5005-1 X.
- Reis A., X. Basogain, M. Olabe, K. Espinosa, S. Cubo, F. Blázquez, P.Pinto, 2009c: Sesiones online con grupos reducidos: tutoría y trabajo colaborativo. II Jornadas de buenas prácticas de e-learning. 25, June 2009, Bilbao, Spain. Campus Virtual EHU, available at http://campusvirtual.ehu.es /eventos/buenas\_practicas\_2009/xabier.htm\_ (Accessed on 10 December 2011)
- Reis A., (Director), 2010ae: Virtual World Best Practices in Education Conference. Video available at http://olcw.thegraal.net/SL/SL\_asVLE/Seminario\_uh 090205f2/Seminario\_uh090205f2.html (Accessed on 10 December 2011)

- Reis A., (Director), 2009h: *To be or not to be M-learning (that it is the Question)*, available at http://olcw.thegraal.net/diversos/mlearning\_london/mlearning\_ london.html (Accessed on 10 December 2011)
- Reis A.,(Director), 2010aa: Las generaciones de e-learning en Rede Tebas Universidad Central de Caracas, Venezuela. Video available at http://www.wetoku.com/redtebas/2xd (Accessed on 10 December 2011)
- Reis A., (Director), 2010ab: *About my experience as a teacher and trainer*, Halmestad University Conference, Sweden Video available at http://olcw.thegraal.net/diversos/1001halmestad/100126-Halmestad/100126-Halmestad.html (Accessed on 10 December 2011)
- Reis A., (Director), 2010ac: *Implementing virtual classrooms*. Uppsala University Conference, Sweden Video available at http://uex.emea.acrobat.com/ p53522716/ (Accessed on 10 December 2011)
- Reis A., (Director), 2010ad: *Aulas TIC Expo didáctica*. Video available at http://olcw.thegraal.net/DLCW09/expodidactica-aulaTIC\_f/expodidactica-aulaTIC\_f.html (Accessed on 10 December 2011)
- Reis, A., 2008a: New technologies and didactics in new methodologies environment, Innsbruck University press, ISBN: 9733902571670
- Reis, A., 2008b: *From e-learning 1.0 to e-learning 3.0 (e-learning generations),* Izhevsk University International Conference - Russia, ISBN: 9785903140428
- Reis, A., X. Basogain, M. Olabe, K. Espinosa, P. Pinto, 2009d: Interactividad 3.0 en la e-educación.V Jornada del Campus Virtual Universidad Complutense de Madrid, Buenas Prácticas e Indicios de Calidad. Madrid February 2009. pp. 154-161, ISBN: 978-84-7491-968-4
- Rosenberg, M., 2001: *e-Learning: Strategies for Delivering Knowledge in the Digital Age*. New York: McGraw-Hill, ISBN: 0-07-136268-1
- Rosenberg, Marc; 2001, e-Learning: Strategies for developing knowledge in the digital age; NY, MacGaw-Hill
- Rosie, A. 2000a: Subject: Different? Discussion Room: OTiS Best Practice for Effective Tutoring, available at http://vls.scotcit.ac.uk/ (Accessed on 28 March 2001)
- Rosie, A. 2000b: Subject: Many learning styles. Discussion Room: OTiS –Tutor and Learner Styles (4), available at http://vls.scotcit.ac.uk/ (Accessed on 28 March 2001)
- Rosie, A., 2000c: Subject: The cultural. Discussion Room: OTiS Best Practice for Effective Tutoring (9), available at http://vls.scotcit.ac.uk/ (Accessed on 20 March 2001)

- Siemens, G., 2005: *Connectivism: A Learning Theory for the Digital Age,* available at http://www.elearnspace.org/Articles/connectivism.htm (Accessed on 14 September 2008)
- Silva, A.J., K.P. Giese, N.B. Fedorov, P.W. Frankland, J.H. Kogan, 1998: Molecular, cellular, and neuroanatomical substrates of place learning. Neurobiol Learn Mem
- Silva, A.J., Y. Elgersma, R. Costa, 2000: *Molecular and cellular mechanisms* of cognitive function: implications to psychiatric disorders. Biol Psychiatry, not published, (PDF)
- Stiles J., 2006: Cognitive *brain development*, avilable at http://www.youtube.com/watch?v=FugrcVhi2tg (Accessed on 20 October 2006)
- Stiles, J. 2006: *Gray Matters*, available at http://video.google.com/videoplay? docid= 5991955507070826102&q=joan+Stiles, new link, http://www.youtube. com/watch?v=FugrcVhi2tg (Accessed on 20 March 2006)
- Street, D., 2000: Subject: none. Discussion Room: OTiS Models of online learning and tutoring (8) available at http://vls.scotcit.ac.uk/ (Accessed on 21 August 2001)
- Winters, E., 2001: Seven styles of learning, available at http://www.firn.edu/~face/about/dec95/mult\_int.html\_(Accessed on 06 March 2001)

#### Video presentation

http://areis-en-learn-teach.blogspot.pt/

# CREATION OF THE UNIVERSITY'S INFORMATION AND EDUCATION SPACE AS A CATALYST FOR THE FORMATION OF TEACHERS' IC COMPETENCE

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**Abstract:** The conceptual basics of the formation of information and education university space are described. The conception of IC competence is clarified, as one of the teacher's key competences. The technology of the realization of content and technological component of the information space are proposed, the features of the formation of the university teacher's IC competence in the conditions of the information society are described.

**Keywords:** Informatization of higher education, information education space, IC competence, modern ICT in education, informational electronic resources, repositories of opened access, cloud computing.

## INTRODUCTION

In the information society information resources and technologies are becoming the most important components of human life activity, which is determined by the global informatization and computerization of human activity in different domains. In the UNESCO worldwide report "To the society of knowledge" it is outlined that "a human will learn, live and work in the environment of distributed instruments, resources and users, to create his own networks of knowledge distribution, to solve the ethical, legal, financial and other problems, connected with the production and the circulation of the information in the network. (To the society of knowledge (UNESCO world wide report)

The main features of the educational system in the information society are the creation of new knowledge, territorial and temporal independence of knowledge acquisition processes, structural and thoughtful updating of the educational process. In this context before the modern education new tasks arise: the informatization of education, which corresponds with the targets of the information society formation,

the distribution of innovative educational practices and the implementation of personalized and competence oriented approaches to teaching, the provision of equal and general access to different informational resources.

The modern destination of the modernization of higher education national system, stipulated by its entering to the global information educational space (IES), requires the experimental approval of the new models of teaching and updates the demand in the forming of information educational space of higher education system. In the frames of national programs of realization in the domain of informatization, in conditions of IES forming of the different levels increases the requirements to the ICT competence of the modern teacher, as one of the key competences.

## I. CONCEPTUAL BASICS OF THE FORMATION OF INFORMATION EDUCATIONAL SPACE

Processes of globalization of education lead to noticeable changes in methodical training systems: aims of teaching are globalized, the content and methods are unified. There appear new forms of teaching technology, which are orientated to the integration of information and communication technologies (ICT) into the teaching process. Especially noticeable changes have occurred within the means of teaching. There has been a transition from the concept "means of teaching" in traditional model of education to the educational environment in activity-orientated pedagogical practice, then to the educational space in the context of personal-orientated, individualized approach, and finally, to the information educational space (IES), which is realized in the process of the development and implementation of ICT (Manako 2011).

IES is determined as a structured complex of the resources and technologies, based on the same standards, which allows provide the interaction of the subjects of educational process within such a space and free access to the informational resources, which are used for the educational tasks solving.

The target of IES formation of the modern university is the "creation of the methodical educational systems, which are orientated for the development of the intellectual potential of the student, formation of skills to get the knowledge independently, to exercise the informational-learning, experimentally-research activity, the different kinds of independent activity for informational data processing (Yaroshenko 2009).

To the main components (objects) of IES will refer:

- *the content component* – the complex of electronic educational resources (EER), which are used (can be used) in the teaching process (teaching, scientific, informational, referential materials, developed in electronic form, presented in electronic media of any type or placed in computer networks, which are used for the organization of efficient educational process, in the segment concerning

its filling with qualitative training-methodology and scientific materials);

- *technological component* the means of informational interaction, which provide the access to EER with the usage of ICT and including the software-technical means (IT-infrastructure, centralized and decentralized services);
- *organizational component* organizational structures, structures which provide the formation, functioning and the development of the informational space.

IES is formed and supported by different subjects, which use the different conceptualizations and decision-making strategies. The subjects (participants) of informational interaction in the frames of IES of the modern university are the administration, teaching staff, students, the general public and employers. The main mechanism of IES formation is the interaction of subjects, united by the same understanding of the informational space conception and pedagogical tasks, the single principles and approaches to teaching, i.e. IES is considered to be not only the unification system of the objects of corresponding purpose, but also the domain of general cognitive interests, on the basis of which informational problems are determined, the concrete aims of their solving are set and the ways of these aims reaching are determined.

Informational space can be realized at the levels of educational institutions, regional, national, world one, what lets to speak about different variants of its functioning. At the aspect of system connection between these spaces the strict hierarchy exists, and, consequently, the succession in invariant properties. At this each of IES presents the independent social-informative system with its specifics and features.

IES of the university presents (has to present) the adaptation model of the global and national informative spaces and inherits its most character functional properties, in particular, in communicative aspect IES is presented as the space of common teaching activity on the ICT basis, in integrative aspect it is assumed as the realization of common actions by the way of the installation of the corresponding rules and the adoption of normative documents, i.e. the space can be formed and developed only in accordance with the goals and the tasks of the above mentioned spaces, with taking into account the normative base of informational policy at the international and national levels, the condition and the perspectives of development of the informational interaction means, the features of teaching realization in educational institution, (Bykov 2008), (Yashina 2005), (Izvozchokov 1999). The analysis of science-pedagogical sources has let to distinguish the following features of such space formation:

- IES is the multi-component pedagogical system, including the informational, technological and organizational resources;
- When forming the IES it is necessary to solve the problem of the correlation of the traditional components of educational process and ICT;
- In the informational space the role of teachers IC-competence increases, because

namely the professor (docent, senior lecturer, assistant) decides in which quality, volume and for what purposes could be used IES resources, i.e. the teacher is the one of the most active participants of such space formation.

We will define IC competence of the teacher as the ability of the educator to solve the wide range of pedagogical tasks, to model and construct the educational activity with the usage of ICT, which envisages the sufficient level of functional literacy in ICT domain, effective and reasonable application of ICT for the solving of the professional, social and personal tasks, the understanding of the ICT role as the basis of a new educational paradigm, which is aimed at the student development, as the objects of information society.

The system of IC competence formation has to be orientated not only to the studying of the specific technologies, but also to:

- Formation, through the teacher, of the methodical approach to the choice and the usage in their own professional activity of the ICT for the reaching of pedagogically significant result at the context of the provision of studying material availability, the improving the quality and increasing the efficiency of studying process;
- Formation of the necessary pedagogical abilities and ICT usage skills when teaching the studying subjects in different educational systems;
- The development of abilities and skills of educational process organization with the ICT usage and the management of innovative educational projects;
- Formation of the necessary knowledge and skills in the domain of pedagogical design and the creation of ICT-orientated means of teaching.

For the implementation of innovative ideas into the pedagogical practice it is necessary to provide the effective interaction and collaboration of the scientific chairs of the university and all its structure subdivisions. Exactly in this way the single scientific-methodical space of the university can be created, in which happens the approval of the new innovative teaching models, the theory and practice are combined, the scientific approach is implemented into the educational practice. For the construction of the scientific-methodical system of the faculty staff preparation to the usage of information and communication technologies in the pedagogical activity it is necessary to take into account the necessity of:

- Module structuring of the content, which reflects the technological and didactic abilities of the usage the concrete information and communication technology;
- Changing (expansion) of the teachers role (moderator, facilitator, trainer) in the models of higher education;
- Selection of the technology for the teacher's preparation to its usage in his professional activity;
- Balance and harmonization of the separate content modules of the pedagogical

stuff preparation program in the domain of ICT and distance learning;

- Determination of pedagogical advisability of ICT usage when developing and realizing the pedagogical process;
- Comprehensive analysis of pedagogical solving of the ICT usage questions in higher education system.

### II. CLOUD COMPUTING AS THE INTEGRATION BASIS OF THE CONTENT FORMATION AND THE TECHNOLOGICAL COMPONENT OF THE INFORMATION AND EDUCATION SPACE

A sudden technologies development, the appearance of the new technological platforms and instrumental means change the approaches to the formation of the technological and content component of IES.

In the annual reports of the International Media consortium it is given the list of computer technologies, which will have (or have) the considerable influence for the organization of the educational-training process in the nearest future, namely: mobile technologies and cloud computing (2009), opened content, electronic books, geoservices, personal web (2010-2011), semantically compatible annexes, Smart-objects, completed reality, (2012-2014), training games, sensor devices and interfaces, data visualization, training analytics (2015-2016) (The Horizon Report: 2009 K-12 Edition, 2009), (The Horizon Report: 2010 K-12 Edition, 2010), (The Horizon Report: 2011 K-12 Edition, 2011).

In UNESCO analytical note "Cloud computing in education" it is indicated, that the "scale effect and other characteristics, inherent to the cloud computing, could become the reason of gradual withdrawal from the placing and providing the informational services in educational institutions. More often these services are provided to the students and teachers via the Internet. Universities get them free or for the low payment, wherein these services are more accessible and reliable then their local analogue (Cloud computing in the education, 2010).

Among the destinations of the cloud computing implementation the software as a service (SaaS) represents the main interest for the modern universities. Let us give the examples of the cloud services, which refer to the given direction: e-mail and office applications (text processor, electronic tables, presentations, etc.), common work instruments, content managing systems, social networks, managing systems by internal and external organisation resources (Cloud Computing Standards Roadmap, 2011).

To the advantages of the cloud computing usage in the domain of education will attribute:

- Facilitation of installation processes, software support and service, which could

be ordered as the internet-service;

- Flexibility in the usage of different types of the software, which could be compared and researched, owing the fact that there will be no need to buy and install it every time;
- Possibility of multi-channel replenishment of collections of educational resources and the organization of multiple access to them;
- Universalization of the processes of distributed teaching owing to virtualization;
- Possibility of dynamic up-building of the software resources;
- Mobility of the teaching due to the usage of communication cloud service, such as e-mail, chat, and also the rendering of the disk space for changing and storing the files, which makes the communication and the organization of the common activity more effective.
- At the same time the transition of the university services to «cloud» contains definite risks, in particular:
- Constant and reliable access to the Internet network is needed;
- Organization of the necessary level of data protection and informational security;
- Some software can function slower then on local computer, in particular it concerns the software providing the graphical data processing.

Thus, the significant feature of the cloud technologies is the perspective of creation of the common infrastructure of the parallel and distributed calculations for the development and the integration of systems, decentralized and centralized services, resources of different types on this basis. Cloud technologies open the way to the development of more completed methods of the multiple access to the electronic resources, and they are the unified methodology of creating teaching platforms, the basis of university IES formation. By the teaching platform it is understood an integrated set of resources, instruments and on-line services for teachers, students and other objects included into the educational process, and intended for the support and enlargement of the possibilities of education obtaining and educational process management. There are distinguished the centralized (education management systems, virtual training environments, systems of teaching content management) educational platforms.

It is obvious that the formation of ICT competence is an important step on the way of the integration of a new technologies into the educational process, but the development of ICT requires a constant perfection of new knowledge, received by teachers, the abilities and skills, it is necessary that the specialist would be ready to use those ICT which will be put in circulation in the nearest future. The training of ICT usage cannot only follow the perfection of the technology, it has to carry the forwarding character, which will allow to reach the following educational purposes:

- To stimulate the usage of modern ICT possibilities for the increasing of teaching efficiency;
- To favor the formation of the experience of the rational distribution of teacher, student and computer in informational educational space ;
- To stimulate the development and the realization of the principles of classes conducting of any type with the usage of all the possibilities of ICT;
- To determine the optimal proportion of the new pedagogical technologies and traditional methods of teaching;
- To promote the realization in the educational process of the personalized orientated approach to teaching.

### III. ORGANIZATION AND MANAGEMENT OF THE CONTENT COMPONENT OF THE INFORMATION SPACE

Increasing the quality of general secondary education is based on the usage of modern EER, providing their accessibility in Internet network. The usage of quality training materials enables students to gain higher education, adequate for modern requirements, not depending on the university's location, it ensures the individualization of educational process, students orientation towards self-education and self-instruction, increasing the level of intensification of the educational process, studying the training material at different levels of complexity and in different volume, the creation of new conditions for possibly the fullest development of the students' general study skills.

The basis of a new conception of training materials construction becomes the objective approach, which foresees the implementation of the principles of fragmentation and discretization of the educational materials and their transfer processes (Telnov 2005), (Zhuge 2004). This conception involves the transition from the development of big rough educational courses to the development of a multitude of educational objects (Reusable Learning Object, RLO), which are used repeatedly, are accessible for the search and the inclusion into concrete educational consecution. Educational materials, developed in such a way, allow the users to search, save, combine them with a view to the formation of a hierarchical structure and share them with other users with ICT support in multiple informational spaces, using the distributed sources, different methods and instruments (Manako, 2004).

The conceptual basis of the formation of educational materials hierarchical structure is the module architecture, i.e. combined content of the subject area is divided for modules, which correspond the topic elements and the components of the educational process. At the same time each module can have an analogue - variation, which differs by the elements of content (educational objects), methodic and realization technology (Electronic educational resources of a new generation, 2011). When creating the modern EER it is necessary to take into account the international approach for creation and usage of opened educational recourses. (Open Educational Resources, OER) and rendering the open access to them (Budapest initiative "Opened access"), (Susand' Antoni Introduction 2009). Opened educational recourse is determined as educational content, meeting all the requirements of independent and self-dependent education, invariant relative to the categories of audience, placed in opened access and containing all the necessary means for the organization of efficient educational process, based on the dialogue and cooperation. In CapeTown Declaration of the opened education it is noted that «... each person has to have the freedom to use, adapt, perfect and distribute the educational resources. Teachers, and all who share these approaches are united into the world-wide movement of the accessible and effective education (The CapeTown Open Education).

In the context of creation and usage of the opened educational resources the particular actuality obtain the numerical archives of the teaching objects, which unite the knowledge of the different training disciplines on the basis of the knowledge management systems principles construction. Creation of the numerical archives (repositories) of the educational resources will let provide the flexible formation of teaching-methodological complexes in accordance with different models of specialists competence, to combine the different sources of informational data for different disciplines, to render the access for the participants of educational-pedagogical process in the frames of a single system; to provide the constant development of the system owing to the renovation of the theoretical knowledge and constant accumulation of a new experience, received by the participants of educational-pedagogical process in the frames of this process; to present the relevant to training targets data for each of its participants in accordance with his knowledge, preferences and needs (Morze 2010a, 2010b), (Yaroshenko 2006), (Barton 2004).

Repository system, which unite the knowledge of different scientific disciplines on the basis of construction principles of knowledge management systems, constitute (can represent) the basis of informational educational space of the region secondary education system.

The creation of the repositories will allow to provide the flexible formation of educational and methodological materials in accordance with different models of teaching, to make these educational and methodological materials significantly cheaper and accessible, and the work with them – more convenient and effective, to increase significantly the efficiency of training, by the way of providing the experience and different training materials changeover between the teachers. Among the other advantages is the wide and measurable access of readers, the easiness of the necessary materials search, powerful readers' audience, integration into the global databases, and the new possibilities for the common projects of different types.

With such approach to the organization and management of IES content component the concept of IC-competence determines which skills and abilities the teacher has to possess, namely:

- Access to information data the ability to find, collect and/or extract information data, using the means and services of Internet network and software for this;
- Informational data management the ability to apply the existing scheme of the organization or classification, to structure the informational data;
- Critical estimation of informational data the ability to give a judgment about the quality, importance, utility or the data efficiency, and also about the reliability, scientific character, address direction;
- Creation of information data the ability to interpret and render the data, to generate the data and the knowledge;
- Changeover of the informational data the ability to properly transfer the informational data into the IES;
- Thus, the teachers in the frames of such approach have to be able (Structure of teachers ICT-competence, 2012):
- To pick and to use in their work the EER;
- To use the network resources, which let the students to work in collaboration to receive the access to informational data and communicate with external experts during the analysis and the decision of chosen by them problems;
- To develop the numerical educational resources and to construct the educational environment;
- To use the ICT for the collection and processing of professionally–considerable information;
- To realize the informational activity for collection, processing, transferring, and keeping the informational resources.

The construction of the distributive repositories system will let create web-orientated knowledge bases of the actual materials, presented in the different formats, to provide the completeness of their representation, to speed up the process of development, publication, repeated usage and the modernization of educational materials and their distribution on the basis of the flexible electronic technologies. Usage of the training materials which have the similar source of origin but which can vary in different educational regions, not only enlarges the circle of the resources, but also will make the education more attractive for the innovations and investments form the side of IT-industry.

## IV. THE FEATURES OF INFORMATIONAL EDUCATIONAL SPACE TECHNOLOGICAL COMPONENT FORMATION

EER of the new generation, diversification of the training materials, implementation of the innovative pedagogical technologies and of modern ICT means stipulated for the transformation of the approaches for the creation of the IES technological component: from the presentation of the wide spectrum of the inbuilt instruments to the provision of personified training interfaces.

Let us point out that the process of education is realized (can be realized) with the usage of many contexts, sources and technologies – students must have the access to the training materials, resources, Internet services and educational platforms.

The key motives in the development of the new education model are becoming the socio-technological features of the modern ICT: distributed data processing, the development and the perfection of the mobile technologies, general intellectual filtration of the content, 3D-virtualization and manageability. The appearance of Web 2.0 and Web 3.0 services, the technologies of cloud computing, the significant enlargement of the possibilities of the distributed data storage and the perfection of its processing ways is leading to the distribution of decentralized educational platforms, which allows:

- To render to all persons concerned the access to the educational resources at the any stage of the training;
- To help to anybody who wants to share their knowledge to find the students, who would like to study with them;
- To render to anybody interested the possibility of publishing their results and projects.

In the global educational practice Web 2.0 services are considered qualitatively new means of the distribution and accumulation of educational materials, effective instruments of the formation of decentralized educational platform (Patarakin 2007), (Graham 2007), (Blees 2009), (Ivanova 2010), (Schaffert 2008). Wiki, blogs, social networks, sites of stream audio and video, new channels let the users collaborate – to change the information data, to save the links and multimedia documents, to create and edit the content etc. Scientists picked out the following arguments in favor of the decentralized platform implementation: individualization and personification of the educational platform, the quality (there is a possibility that separate elements of centralized educational platforms would not be as good as specialized instruments), the flexibility, the possibility of meeting the pedagogical requirements, updating, and teacher's control.

Pedagogically adjusted and methodically grounded application of these technologies creates the conditions for:

- Common use of the opened, free, network resources;

- Independent creation of network training content (new services significantly simplified the process of materials creation and their placement in the network, thanking for this each one can not only to receive the access to the numerical collections, but to form its own);
- Productive common activity (participation in professional communities distance learning, common projects).

The analysis of the publications has revealed, that for the realization of the technological component of IES can different combinations of Web 2.0 and Web 3.0 services be used, which opens before the pedagogical practice the following possibilities:

- Openness and general access to the informational content of the electronic resources. As the result of the common activity of the users it is collected the huge quantity of the training materials, which are accessible to the all users ;
- The process of creation and publication of the training material in the network is accessible to all the users. Each of them has not only the access to teaching numeric collection, but also can independently form his own network content: texts, pictures, photos, audio and video files, didactical materials, etc.;
- Experience changeover. The usage of Internet network through the social services opens the new possibilities of the common activity and further collaboration with colleagues.

The implementation of the decentralized educational platforms requires the expansion of the knowledge, skills, and abilities of the teachers in the domain of possessing the communicative technologies abs social services. At this it is important not only to form the conception about the instruments of social services Web 2.0 and Web 3.0, their destination and structure, but also to get them acquainted with the possibilities of their usage in the educational process, principles of classes conducting with its usage, the usage of Web 2.0 services for teaching in the specific subject domain. With such approach the work of teachers is becoming one of the serious didactic instruments of their IC-competence formation.

In IES the important role is played by the communities into which in the frames of common activity subjects are united. With the help of the Internet and social services are interconnected not only the computers and the documents, but also people, who use these computers, documents and services. The basis of the networks community is constituted by the easy interactions of the participants, messages changeover, social services, which represent the network software, (first of all these are modern assets Web 2.0) for the support of group interaction (Patarakin 2007).

Considering the process of the teaching form the position of virtual communities' creation, it is possible to mark out the following features:

- Training and teaching cannot be totally controlled by the individual - the external support is needed that lets the students ascend the higher level of

material familiarization and new knowledge production;

- Training and teaching are always the process where the ability to install the connections between the knowledge branches, conceptions, ideas is the key one, and the available knowledge is more important;
- Training is the constant process of decision making;
- Training is taking place in the community of messages changeover where the beginners gradually are becoming the experts through the active practical activity;
- Training is taking place as the process of network formation in accordance with the theory of connectionism.

For the professional usage of the social networks instruments the teacher has to possess formed conceptions about the sense of network interaction in the professional development of the teacher, existing professional teachers' communities and social networks, electronic educational resources and the possibilities of their usage in professional activity and others, which assists the development of their IC-competence.

Today in educational practice the processes of formation of the decentralized educational platforms haven't yet received the wide expansion, whereas the network interaction in professional and social domains is the usual event. By the opinion of the authors, the modern network technologies are the basis for the formation of the technological component of IES and the organization of educational communities. The implementation of the decentralized educational platform of training process organization in educational institutions will let provide the support of students in raising of their own educational targets, in management of the educational materials and their own educational process, in the communication with other participants of the educational process.

## CONCLUSION

One of the prospective ways of the perfection of the information support of the educational process in the higher education system is the forming of IES. It allows for creating conditions for supporting the learner's self-development at the most, providing the processes of humanization of education and increasing its creativity, favouring culture formed naturally, which is generated by the informational epoch, are realized the interests and needs of the individual and social groups.

IES has to be built as a system, by its essence comprising the unity of functionally and structurally interconnected informational and technological elements, skilled usage of which in pedagogical practice will let the teacher in the conditions of education informatization solve the didactic issues on the technological basis with the quality guaranteed. The usage in the educational process of the IES resources is aimed at the intensification of the training process, perfection of the forms and methods of training process organization, which provides the transition from the mechanical learning by students of evident knowledge to their acquiring of abilities to gain new knowledge independently.

Efficient usage of the wide spectrum of IES resources is connected today with the formation of the IC-competence as the most important component of the key competence of the educational process participants. The issue of the preparation of the pedagogical staff for higher school, who possess the necessary level of the IC competence has arisen at all the levels of the state system of the pedagogical education (pre-university preparation, preparation in university, after-university preparation).

IC competence of the pedagogical staff has to provide the realization of the new educational targets and the new content of educational activity, the implementation of the new forms of educational process organization. At that the necessary conditions of teachers IC-competence forming and development are:

- The readiness of the teacher to the constant self-education and increasing the qualification in ICT domain;
- The teachers being prepared to the decision of the problems of the educational process efficiency increasing on the basis of modern ICT;
- Constant enlargement of the ICT possibilities usage spectrum in educational process and professional activity;
- Informational-methodological provision of the educational process in the domain of ICT usage, which would let the teachers of the different branches of science realize the principle of poly-functionality;
- Constant support and consulting over the questions of IES resources usage.

### REFERENCES

- Barton, M., 2004: Creating an Institutional Repository: LEADIRS Workbook [Electronic resource] / Barton M., Waters M.// MIT Libraries' Digital Institutional Repository, 2004, 134 p., available at http://dspace.mit.edu/ handle/1721.1/26698 (accessed on 08 September 2012).
- Blees, I. 2009: Web 2.0 Learning Environment: Concept, Implementation, Evaluation [Electronic resource]/ Ingo Blees, Marc Rittberger //eLearning Papers. 2009. no.º15. 18 p. available at http://www.elearningeuro pa.info/en/article/Web-2.0-Learning-Environment%3A-Concept%2C-Implementation%2C-Evaluation (accessed on 08 September 2012).

- Budapest initiative "*Opened access*" [Electronic resource] //Web-site of V.I. Vernadskiy National library of Ukraine, available at http://www.nbuv.gov.ua /law/02\_boai.html (accessed on 08 September 2012)
- Bykov, V.,Y., 2008: Automatized informational systems of the common informational space of the education and science // Collection of Scholarly Papers of Pavlo Tychyna Uman State Pedagogical University. – Uman: SEA Zhovtyi, 2008, p. 2., pp. 47–56 [In Ukrainian]
- Cloud Computing Standards Roadmap (NIST-SP500-291) [Electronic resource] // National Institute of Standards and Techology, 2011, 76p. available at http://www.nist.gov/customcf/get\_pdf. cfm?pub\_id=909024 (accessed on 08 September 2012).
- Cloud computing in the education [Electronic resource] // UNESCO institute of the informational technologies in the education. 2010. 12 c. available at http://iite.unesco.org/pics/publications/ru/files/3214674.pdf (accessed on 08 September 2012).
- Electronic educational resources of a new generation [Electronic resource] // UNESCO institute of the informational technologies in the education, 2011, p. 12 available at: http://iite.unesco.org/pics /publications/ru/files/3214693.pdf (accessed on 08 September 2012).
- Graham A., 2007: The Personal Learning Environments the future of eLearning? // eLearning Papers. -.-vol. 2 - no. 1.-8 p.
- Ivanova, M., 2010: Involving students in managing their own learning [Electronic resource] / M. Ivanova, T. Ivanova //eLearningPapers.- 2010.- no 21. - 13 p. available at: http://www.elearningeuropa.info/en/article/Involvingstudents-in-managing-their-own-learning (accessed on 08 September 2012)
- Izvozchokov, V., 1999: The conception of the pedagogy of the informational society, V. Izvozchokov, V. Laptev, M. Potemkin // Science and school. – 1999. – No 1.– P. 41-45.
- Manako, A., F., 2004: Model of the aggregation of the constant teaching objects with the support of informative and telecommunicate technologies : [Collection of scholarly papers, Mykolaiv State University.] / A. F. Manako, 2004. Issue 22. V.35. P.100 108. [In Ukrainian]
- Manako, A., F., 2011: Evolution and convergence of informative technologies of education and studying support / A. F. Manako // ITEA-2011. IRTC, Kyiv. p.3-19. [In Ukrainian]
- Morze, N.,V., 2010: Institutional repository of the modern university and realization ways of the opened access initiative. / N.V. Morze, O.G. Kuzminska // II International forum 'The problems of informational society development" Part I. K.: UkrINTEI, 2010. p. 252. [In Ukrainian]

- Morze, N., V., 2010: Creation of the electronic library of the university in the EPrints environment / N.V. Morze, O.G. Kuzminska // Science journal of National Pedagogical Dragomanov University. Series 5. Pedagogical sciences: realities and perspectives K.: Publishing house Dragomanov National Pedagogical University, 2010, Issue 22 [In Ukrainian]
- Patarakin, Y., D., 2007: Creation of the pupils, students and teachers communities on the basis of Web 2.0 network services [Text] / Y.D. Patarakin.
  K.: Scientific-methodical center "Consortium for management education perfection in Ukraine", 2007. 88 p. [In Ukrainian]
- Patarakin, Y., D., 2007: Social services Web 2.0 to a teacher's help. Y.D.Patarakin, 2nd edition, corrected. M: Intuit.ru, 2007. 64 p.: ill.
- Schaffert S., 2008: On the way towards Personal Learning Environments: Seven crucial aspects [Electronic resource] / Sandra Schaffert, Wolf Hilzensauer // eLearningPapers. 2008, no 9, available at http://www.elearningeuropa.info/en/ article/On-the-way-towards-Personal-Learning-Environments%3A-Sevencrucial-aspects (accessed on 08 September 2012).
- Structure of teachers ICT-competence. [Electronic resource] // UNESCO institute of the informational technologies in the education [site]. 2011. available at: http://iite.unesco.org/pics/publications/ru/files/3214694.pdf (accessed on 08 September 2012)
- Susand' Antoni Introduction. Open Educational Resources: *Conversations in Cyberspace* [Electronic resource]// UNESCO Publishing. 2009. available at http://oerwiki.iiep.unesco.org/index.php/Open\_Educational\_Resources:\_Conversations\_in\_Cyberspace (accessed on 08 September 2012).
- Telnov, Y.,F., 2005: *Electronic studying in opened educational environment at thebasis of creation the integrated knowledge space* / Y.F. Telnov// Opened eduction, 2005. No 3. P. 22 30.
- The CapeTown Open Education Declaration, available at http://www.capetowndeclaration.org/translations/ukrainian-translation (accessed on 08 September 2012)
- The Horizon Report: 2009 K-12 Edition [Electronic resource] // New Media Consortium. 2009. 36 p. available at: http://www.nmc.org/pdf/2009-Horizon-Report.pdf (accessed on 08 September 2012)
- The Horizon Report: 2010 K-12 Edition [Electronic resource] // New Media Consortium. 2010 40 p. available at http://www.nmc.org/publications/horizon-report-2010-k-12-edition (accessed on 08 September 2012)
- The Horizon Report: 2011 K-12 Edition [Electronic resource] // New Media Consortium. 2011. 40 p. available at http://www.nmc.org/pdf/2011Horizon-Report-K12.pdf (accessed on 08 September 2012)

- To the society of knowledge (UNESCO world wide report) [Electronic resource]// UNESCO database. 2005. P. 231 available at http://unesdoc.unesco. org/images/0014/001418/141843r.pdf (accessed on 08 September 2012).
- Yaroshenko, A.,O., 2009: Potential and efficiency of the educational-informative policy/ A.O.
   Yaroshenko. K.: National Pedagogical Dragomanov University 2009. p. 256. [In Ukrainian]
- Yaroshenko, T.,O., 2006: Scientific information in the opened access: new communication models in the informational society / T.O. Yarishenko // Library science. Documentation. Information theory. 2006. no. 4. p. 80-87. [In Ukrainian]
- Yashina, T., S., 2005: About the concept and structure of the common informational educational space (CIES) / T.S. Yashina, A.V. Mogilev // Education informatization 2005: materials of the international scientificpractice conference. – Yelets: A. I. Bunin Yelets State university, 2005. P. 330-338
- Zhuge, H. 2004: *Resource space model, its design method and applications* [Electronic resource] //The Journal of Systems and Software (JSS). – 2004. – No 72. 71–81 p. available at http://www.informatik.uni-trier.de/~ley/db/ journals/jss/jss72.html (accessed on 08 September 2012)

# MIND MAPS IN ELEARNING COURSE DEVELOPMENT

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Abstract: The paper describes the development life cycle of an eLearning course called The Internet marketing. The issue of the Internet marketing is extensive and complex. Some of its areas are design, development and editing of business websites, search engine optimization (SEO), social media marketing, mobile marketing, e-business, e-commerce and e-shopping and also marketing research and analyses. Partial components of the Internet marketing are interconnected. We use mind maps in the course design. They represent not only partial areas and elements of the Internet marketing but also semantic links between them. The eLearning course is especially intended for small and medium enterprises. Owners and managers of these companies appreciate the opportunity of distance learning. The Kirkpatrick's four-level evaluation model was used for the quality assessment of the eLearning course of the Internet marketing. Above all, the participants greatly appreciated the use of mind maps that help them understand the complicated structure of the Internet marketing.

**Keywords**: eLearning course, mind maps, Internet marketing, evaluation, small and medium enterprise (SME)

### **INTRODUCTION**

Internet marketing course emerged as one of the theses (Staško, 2012) assigned at our Information and Communication Technology (ICT) department at the Pedagogical Faculty, University of Ostrava. The requirement for the course arose especially from small and medium-sized businessmen who do not have enough time to follow the latest techniques and trends in the Internet marketing. In this sector, entrepreneurs are often narrowly specialized and do not know what possibilities there are in the Internet marketing and keep relegating this activity to the background. Browsing websites and studying literature is so time-consuming for them that they prefer to address a service provider. However, they want to have at least a basic overview of what to ask, what benefits it will bring and how to evaluate these activities. If they know the latest trends and news, they will also have more accurate, more factual and constructive requirements and during the implementation of the Internet marketing will be an equal partner of the supplier.

Both the design and the development of the eLearning course were based on the Instructional System Design (ISD), which is an educational parallel to software development systems (qtd. in Kapounová and Pavlíček 2003). System lifecycle addresses all phases of the system design.

For the research of business entities and their Internet marketing, the method of qualitative research based on case studies was used. The research of the course quality was then carried out with the help of the Kirkpatrick's four-level evaluation model (Kirkpatrick 2009).

Mind maps also form an important part of the designed course. They aim to help learners facilitate the understanding of complex issues with the help of network graphs, which show relationships between individual elements (Mašek and Zikmundová 2010).

## **1. THEORETICAL BACKGROUND**

Before starting work, it was necessary to know the current knowledge in several, seemingly unrelated, areas:

- the Internet marketing;
- small and medium-sized enterprises;
- Instructional System Design for eLearning courses;
- approaches to eLearning courses evaluation;
- tools for visualisation of structures and relationships between information;
- methods of qualitative research.

Gathered information was used in development and evaluation of eLearning course.

### **1.1 Internet marketing**

The concept of the *Internet marketing* encompasses all marketing activities on the Internet, whereas *online marketing* extends these activities to the marketing via mobile phones or similar devices (Janouch 2010). The Internet marketing (online marketing) can also be simply defined as the usage of the Internet for the achievement of marketing objectives (Sedláček 2006).

The Internet marketing for the sector of small and medium-sized companies is regarded as one of the key factors that help increase the turnover. For this approach we have adopted the following concept. As small companies have in most cases a smaller turnover, they have to address more people. One possibility of how to do this is through the Internet marketing, whose main task would then be to offer the customers the product or information they are searching for on the Internet and ensure thus profit. Other tasks may include product support, communication with customers, brand building and others.

### 1.2 Small and medium-sized enterprises

Small and medium-sized enterprises (SME) form an important sector of the market economy, despite having a low number of employees. The attention devoted to this sector consists in its specific advantages, disadvantages and hence its vulnerability.

Advantages:

- relative flexibility, speed of response (including the creation and destruction of firms) to changes in market conditions;
- relatively high ability to absorb the workforce;
- the ability to fill a gap in the structure of business relationships between large firms (the role of a subcontractor).

Disadvantages:

- more difficult and hence costly access to capital, information and knowledge;
- less ability to eliminate the effects of external influences in the early stages of development (start-up);

Disadvantages from the point of view of the Internet marketing:

- limited resources for promotion and advertising;
- frequent suppression of marketing activities for the benefit of net trade.

## 1.3 Model ADDIE

The course was design based on the standard procedure for the creation of courses ADDIE. This model represents the general systematic step framework used by educational designers, developers and trainers, whose main task is to ensure that the development of the course and education will not happen in a haphazard and unstructured way (Sedláčková 2011).

The model consists of the following stages (qtd. in Kapounová and Pavlíček 2003):

- analysis;
- design;
- development;
- implementation;
- evaluation.

Yet, the principal evaluation criterion is whether the program actually teaches what it is intended for.

## 1.4 Kirkpatrick's evaluation model

When evaluating the effectiveness of training, a model created by Donald Kirkpartick in the mid-twentieth century is often used. This model was originally designed for the evaluation of adult education, particularly in the business sector. It encompasses four levels of evaluation:

- 1. reaction;
- 2. learning;
- 3. behaviour;
- 4. result.

Each higher level depends on mastering the level before, which can be visualized as a pyramid. Kirkpatrick's four-level model was revised after 50 years (Kirkpatrick J. and Kirkpatrick W.K. 2009). As with the original version, its key concept is the interconnection of teaching with practice. Yet, the main indicator of the educational value is the Return On Expectations (ROE).

## 1.5 Mind maps

A mind map is a diagram used to visually outline the structure and relationships between individual pieces of information. It is often created based on a central term, category or thought, from which sub-branched and derived entities emerge.

Mind maps can be used for:

- representation of structures and relationships;
- representation of procedures and processes;
- problem-solving;
- collaboration, team building and synergy creating activity, etc.

Apart from these examples of usage, mind maps can also be analyzed using classical methods for obtaining information or used in expert systems and search engines.

## 1.6 Case studies

The assessment of the value of the eLearning course was carried out according to the "multi-case study" by Yin (2009). In the selection of cases, a replication strategy was applied, which is based on the implementation of several case studies, where the cases are not selected according to the logic of statistical survey and do not represent statistical units. Yin points out the analogy with experimental research and assumes that each case actually represents a new experiment, which is used for the verification or refutation of current knowledge. Yin recommends studying a limited number of carefully selected cases. Subsequently, the conclusions derived from

these examples will enable the confirmation or modification of assumptions or a structural or content-related modification of the course.

## 2. INTERNET MARKETING COURSE

The Internet marketing course has been prepared for managers and employees in the sector of small and medium-sized companies. It gathers information about the Internet marketing from different sources – websites, journals and books. The course not only provides a comprehensive overview, but also tries to show the best possible strategy in the development of a company website. For a better understanding of the information contained in the course, mind maps showing the relations between different parts of the Internet marketing are used. A particular care is devoted to a better understanding of the issue as a whole. As examples of good practice, case studies are provided.

The course is an asynchronous version of eLearning, which is less demanding and does not require a permanent connection to the computer network. Communication between tutors and learners is realized through emails, social networks, etc.

### 2.1 Course structure

As already mentioned, the course was developed on the Instructional System Design (ISD) principles. It goes through system development life-cycle phases: Analysis – Design – Development – Implementation – Evaluation.

#### Analysis

Analysis consists in the identification of the problem, determination of educational needs and estimation of costs. At present, the SME sector has to face the problem of insufficient awareness of possible usages and ways of the Internet marketing implementation. This should be solved by our educational tool. The development of such a tool, while maintaining low or zero prices for students, is conditioned by the ability to find resources aimed for the support of small and medium-sized enterprises. The overall price includes the costs connected with staffing, development, implementation, maintenance and promotion.

What is the interest in eLearning course? We used a SWOT analysis (Strengths – Weaknesses – Opportunities – Threats).

	Helpful to achieving the objective	Harmful to achieving the objective		
internal origin structure of the organisation	Strengths experienced team up-to-date content superior marketing uniqueness of the project	<ul> <li>Weaknesses</li> <li>limited budget</li> <li>small workforce</li> <li>lack of personalization of content</li> </ul>		

SWOT analysis of demand

Table 1.

external origin attributes of the environment	Opportunities <ul> <li>use of social networks</li> <li>publications in a zines</li> </ul>	Threats <ul> <li>development of a</li> </ul>
	<ul> <li>publications in e-zines</li> <li>interest from sole traders</li> <li>heterogeneity of competitive projects</li> </ul>	<ul><li>competitive course</li><li>course acquisition</li><li>lowering of interest</li></ul>

#### Design

In this phase a detailed design of the course is prepared. The ideas of the authors are transformed into a concrete form shared among the members of the solving team.



#### Figure 1. Staffing

Apart from the prototype mentioned above, also the timeline of the course preparation is planned. And tasks, their order and time demands are specified. Basic questions are answered, such as the following:

- Who is the course aimed for?
- What are the specifics of the target group? What is the age range of this group? What is the level of education in this group? What is the profession of this group?

- What is the expected input knowledge of the participants?
- What is the objective of the course? What is the supposed output knowledge of the participants?
- What is the context of the course realization? Why should the participants undergo the course? Is it a mandatory course within an educational institution or at work? Or is it a course of interest?

The staffing is managed by the course manager and has a certain hierarchy. The personal structure can be depicted graphically as follows:

For the effective definition of targets, we have chosen the SMART method:

- specific;
- measurable;
- attainable;
- relevant;
- time-bound.

#### Development

The development phase is the most time-consuming and capacity-demanding part. Having been finished, a pilot testing of the created course should be carried out. Possible imperfections have to be sorted out and eliminated before the next phase.

The company website requires its promotion, style, chance to be found among competition, statistics, availability, corporate identity, good structure, applicability, attractiveness, validity, safety.

The course is divided into five chapters:

- Introduction motivation of students and answers to questions like "What makes the Internet marketing specific? What benefits does it bring? and What are its drawbacks?".
- Company and customer specifies customers' requirements and relates them to company activities.
- Internet marketing components the main component of the Internet marketing is the company website. As this chapter is the most extensive one, it is further divided into subchapters.
- Internet marketing implementation a possible procedure of implementation in company including individual phases of implementation.
- Case study practical demonstration on a real life subject.



Figure 2. Example of the course mind map

Apart from the main topics of the course, other parts providing further information are included (dictionary of terms, literature, autotests, course navigation, contact with the tutor, etc). Tools for testing are also available – pre- and post-questionnaires.

The web-based interface was made using the PHP and MySQL technologies, which sufficiently cover the necessities of the course. The course can be found on http://lambdacomp.cz/moderni-web.

### Implementation

Implementation is relatively easy, once you have chosen appropriate webhosting. The access to the course is ensured via the Internet and the learning process is run in the form of a self-study. Study materials are supplied by the author, who follows the news and updates the course if necessary. The course is available 24/7.

We mustn't forget public relations either. Promotion is carried out via Facebook social network and also by addressing people who might be interested in this course and who could pass the information about the course on to other people.

### Evaluation

According to Sedláčková (2011), there are two types of evaluation: formative and summative. Formative evaluation is carried throughout individual development phases of the course. Its objective is to prepare the course as well as possible before its actual launch. Summative evaluation is run after the implementation of the course and brings direct observations from its participants.

# 3. SURVEY

The goal of the survey was to find out how is the interest in the Internet marketing course in small and medium-sized enterprises and how it is evaluated by its participants. Based on the analysis of the survey results, appropriate adjustments of the course were carried out.

## 3.1 Preparation of the survey

Method



## Figure 3. Structure of survey

The procedure derives from the scheme of the "multi-case study" according to Yin (1994). Replicative approach to multi-case studies means that each case study stands for a separate study. We work with similar cases, where we can expect similar results. Each case is investigated and assessed separately.

### Assumption

We expect that the sector of small and medium enterprises will be interested in the course and also that they will try to use the components of the Internet marketing learnt in the course. At present, every company has its website. However, it is doubtful whether they know the possibilities offered by the Internet marketing. We want to demonstrate the importance of the eLearning course for the given target group and show that the knowledge gained in the course is useful and that the respondents can use it in practice.

### Selection of subjects

The survey was carried out in six companies characterized according to their size and business sphere.

#### Table 2.

Company	Size	Sphere
Elmax	medium	goods, electronics, white technologies
Autobártek	small/medium	goods/services, car repairs
Kamenictví Karásek	small	goods/services, stonemasonry
Restaurace U Hučky	small	services, gastronomy
Foto Mročka	micro	services, photo studio
Fa Záviš	micro	services, safety doors

### **Characteristics of participating companies**

#### 3.2 Experiment description

At the beginning of the experiment, we assessed the current state of the company's website (structure, clear arrangement, availability and validity), whether any analytic tool (e.g. Google Analytics) has been implemented, what the structure of links is and how the possibilities of electronic communication with customers are being used. A validator of HTML code (http://validator.w3.org) and a tool for SEO on-page factors check (http://seo-servis.cz a http://www.seotest.cz) were used.

#### 3.3 Case studies

The data was obtained from questionnaires filled in by the course participants. When needed, the information was specified in interviews with the respondents.

Before taking the course, the participants filled in a pre-questionnaire. Its purpose was to find out basic information about the company, its size, focus, their investments in and attitude to the Internet marketing. Their acquaintance with the topic was investigated in the form of a test containing 24 questions.

A post-questionnaire was given to the participants after the course had finished. It was divided into two parts and on the whole it consisted of 31 questions. The first part was focused on the first level of the Kirkpatrick's model, i.e. on the reactions to the course, namely what the participants think and feel during the course. The second part of the questionnaire was concentrated on the second level of the Kirkpatrick's model, i.e. on the influence of the course on their opinions, skill improvement or knowledge perfection. The analysis of the obtained data showed what effect the eLearning course has on the change of attitudes and whether the ability to apply the strategy of implementation of the Internet marketing in the company has increased. The necessity of the course for the sector of small and medium companies was proved.

#### 3.4 Survey results

The pre-questionnaires demonstrate clearly that almost all addressed enterprises have a company website today. The amounts, which they are willing to invest in the Internet marketing, rise proportionally to the size of the company from 10 to 50 thousands of CZK. The objective of most company websites is mainly to display their products. However, in all cases they do not meet their owners' expectations mainly due to their poor structure, old-fashioned design or bad accessibility. All addressed companies were keen on improving their online presentation and expected the course will provide them with basic information about the possibilities offered by the Internet marketing.

Post-questionnaires showed that:

- no course participant had a major problem with the navigation in the course, which was evaluated as user-friendly and comprehensible;
- mind maps in the course were accepted enthusiastically and the participants appraised them as a very useful tool for understanding the complicated structure of the Internet marketing;
- the dictionary of terms was used rather sporadically and the good structure of the text was appreciated;
- the help of the tutor was rarely used, the course was led by the participants themselves and its structure and other elements helped them understand the content of the course easily;
- all respondents like to apply the gained information in their companies;
- the respondents mainly from micro and small companies can do only with a basic introduction to the topic, as they want to have their Internet marketing taken care of by an authorized company;
- the respondents should like to have more case studies in the course;
- the respondents stated that their communication with customers is on a low level, and one half of them would welcome the use of social networks in public relations sphere as well as for the feedback from their customers.

## CONCLUSION

After the evaluation of the case studies we can state that:

- the companies were not familiar with all possibilities that the Internet marketing offers and they focused only on the designing their company websites;
- the eLearning course was beneficial for the companies in making them realize that a company website is only a part of a more complex system of the Internet marketing.

The evaluation of the course used the first two levels of the Kirkpatrick's model of evaluation.

The first level of evaluation – reaction: The participants responded positively to the course, because it satisfied their needs and managed to attract their attention. A powerful motivating factor was that this was a course of interest. There was a positive reaction to mind maps. These structured overviews in a graphic form served especially well at presentations of complex units, their components and relations to other parts of the Internet marketing. Case studies describing the application of individual items in a real-life company were also received positively. More cases of this kind were demanded.

The second level of evaluation deals with the progress rate in skills, knowledge and attitudes. The course has changed attitudes and understanding of the Internet marketing of all participants. Mainly, they established the concept of the Internet marketing as a complex system, in which all its components are somehow interconnected. The participants improved their analytical skills and ability to measure, and they learnt how to apply and set the elements of the Internet marketing. The analysis of questionnaires shows the increase in knowledge by 50 % on average.

## REFERENCES

- Buzan, T., and Buzan, B., 2011: *Myšlenkové mapy: probuďte svou kreativitu, zlepšete svou paměť, změňte svůj život.* [Mind maps: Awake your creativity, improve your memory, change your life.] Computer Press, Brno, 2011, ISBN: 978-80-251-2910-4
- Hendl, J., 2008: Kvalitativní výzkum: základní teorie, metody a aplikace. [Qualitative research: basic theory, methods and applications.] Portál, Praha, 2008, ISBN: 978-80-7367-485-4
- Janouch, V., 2010: Internetový marketing: prosaďte se na webu a sociálních sítích. [Internet Marketing: Set up yourself on the web and social networks.] Computer Press, Brno, 2010, ISBN: 978-80-251-2795-7
- Kirkpatrick, D.: *The Kirkpatrick Philosophy*. [online]. 2009 Available at http://www.kirkpatrickpartners.com/OurPhilosophy/tabid/66/Default.aspx (Accessed 01 May 2013)
- Kirkpatrick, J., and Kirkpatrick, W., K.: Kirkpatrickův čtyřúrovňový model: nový pohled po 50 letech. [Kirkpatrick four-level model: a new look after 50 years.] [online], 2009, available at http://www.develor.cz/ develorcz\_files/File/kirkpatrickovy4urovne-novypohledpo50letech2.pdf (Accessed 01 May 2013)

- Kapoun, P., 2008: *Marketing a marketingové komunikace*. [Marketing and Marketing Communications.] University of Ostrava, 2008, ISBN: 978-80-7368-566-9
- Kapoun, P., Staško, J., 2012: Use of Concept Maps in eLearning Course. Proceedings of the 2012 ICTE Annual Conference: University of Ostrava, 2012, pp. 95-102, ISBN: 978-80-7368-979-7
- Kapounová, J., and Pavlíček, J., 2003: *Počítače ve výuce a učení*. [Computers in teaching and learning.] University of Ostrava, 2003, ISBN: 80-704-2265-3.
- Kupka, V.,: Malé a střední podniky: jejich místo a role v české ekonomice. [Small and medium-sized enterprises: their place and role in the Czech economy.] In: *Czech Statistical Office* [online], 2010, available at http://www.czso.cz/ csu/csu.nsf/informace/ckta090307.doc (Accessed 01 May 2013)
- Mašek, J., and Zikmundová, V., 2010: Výukové využití softwarových systémů pro techniku pojmového mapování. [Educational use of software systems for conceptual mapping technique.] University of West Bohemia, Plzeň, 2010, ISBN: 978-807-0436-318
- Nwankwo, S., and Gbadamosi, A., 2011: *Entrepreneurship marketing:* principles and practice of SME marketing. Routledge, New York, 2011, ISBN: 978-020-3838-648
- O'Dwyer, M., 2009: *Marketing the SME: innovation and approach*. Cambridge Scholars Pub., Newcastle upon Tyne, 2009, ISBN: 14-438-0575-0
- Sedláček, J., 2006: *E-komerce, internetový a mobil marketing od A do Z.* [E-commerce, internet and mobile marketing from A to Z.] BEN technická literatura, Praha, 2006, ISBN: 80-730-0195-0
- Sedláčková, B. E-LKA2: E-learningový kurz knihovnické angličtiny. Part I. Inflow [online]. 2011 Available at http://www.inflow.cz/elearningovy-kurzknihovnicke-anglictiny-2-elka2 (Accessed on 01 May 2013)
- Staško, J. E-learningový kurz elektronického marketingu pro sektor malého a středního podnikání. [E-learning course on e-marketing sector of small and medium-sized enterprises.] Diploma thesis. University of Ostrava, 2012. Supervisor Kapoun, P.
- Švaříček, R. and Šeďová, K. *Kvalitativní výzkum v pedagogických vědách*. [Qualitative Research in Educational Sciences.] Portál, Praha, 2007, ISBN: 978-80-7367-313-0
- Using Mind Maps ® Effectively. [online] Available at http://www.mindmapping.co.uk/ (Accessed on 01 May 2013)
- Yin, R. K. Case study research: design and methods. Sage, Los Angeles, 2009, ISBN: 978-1-4129-6099-1

Zlámalová, H. *Distanční vzdělávání a eLearning: učební text pro distanční studium*. [Distance learning and eLearning: a textbook for distance learning.] Jan Amos Komensky University, Praha, 2008, ISBN: 978-808-6723-563

# HOW DO I LEARN? A CASE STUDY OF LIFELONG LEARNING OF EUROPEAN YOUNG

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Abstract: European young people are categorized as the New Learners Millenium that learn at everyplace and everywhere, by their own and/or in community, such as in real as virtual world. Thus, learning can be provided by educational institutions as well as informal online scenarios, where information is freely distributed at any time. The core question in this field is about the relation between formal education and process of acquiring knowledge. The paper shows findings about some perspectives in that mater presented by participants of the Council of Europe project entitled Edgeryders.

Keywords: Learning, Lifelong Learning, Youth, Europe, Education

### **INTRODUCTION**

In 2012 the authors were invited, as semi-external experts who would confront ideas of Edgeryders with existing European educational policies (full report Gutiérrez and Mikiewicz 2013), to participate in the works of the Edgeryders project (http://edgeryders.eu) - an action of the European Commission and the Council of Europe. The project's goal was to collect knowledge about contemporary youth perspectives on transition into adulthood processes. The core of the initiative was to build the internet platform (http://edgeryders.wikispiral.org/) as an interactive, horizontal sphere of discussion and sharing experiences concerning the transitions of young people around the world (not just in the European Union). In effect, more than 2,100 participants logged in from very different parts of the world. Several topics called 'Campaigns', were established with invitation for all sort of information and commentary from participants. Each campaign (Making a living, We the people, Living together, Caring for commons, Learning, Resilience) contemplated several Missions (questions to answer and aims to achieve) and participants voluntarily contributed with their own 'reports'. Mainly there were short entries, with personal statements about discussed topics, but sometimes it was quite sophisticated elaboration. In the end the project brought about very interesting research material about contemporary youth perspectives. The basic outcomes of analyses are presented in the report of Collins and Farrel (2013).

Recruitment to participate in the project, had the nature of networking, contributing with their experience and further promote the idea of Edgeryders, which also has the diagnostic ambitions based on social innovation<sup>1</sup>, what resulted with certain advantages and disadvantages at the same time. This is not, therefore, a representative group (in the sociological sense) in relation to any population. Edgeryders are a group itself, a community, with a very diverse set of participants from national or ethnic composition of the group but with a certain kind of social and cultural experience in common, such as the education and experience of the transition from education to the labour market/adulthood. Referring to the terminology of Bourdieu (1992), we could call it a **habitus**, formed on the basis of similar conditions of socialization and experiencing the successive transition through the system of education and entry into maturity.

## **1. NEW LEARNING SCENARIOS**

What their experiences contribute to the discussion on nowadays ways of learning and using knowledge?. Learning is a growing concept: it is always developing. We could even talk about a new learning culture that breaks traditionally offered situations for learning. In fact, there are many different new ways and kinds of learning. The most popular: formal, informal, online and lifelong learning and the lately born: invisible learning (Cobo and Moravec 2011), edupunk, edupop, incidental learning, ubiquitous learning... (Beetham, McGill and Littlejohn 2009), the key idea is that with the introduction of ICT and mainly Internet in our lives, we could **learn at any place and at any time** (everywhere&everytime learning: EEL), what by some scholars have been labeled as **mobile learning**. Citizenship has been moved from Formal Schooling Paradigm to Do It Yourself (DIY).

In addition to this new social, economic and cultural scenario, the development and infrastructure improvement of Information and Communication Technologies, led to emergence of a new set of technologies used in distance learning called Virtual Learning Environments, not only for the implementation of mixed systems of education, which brought distance education to traditional school, but also with the inclusion of particular online methods for training. Consequently during the last few years, the profusion of b-learning, e-learning and m-learning has been taking place. Where classroom teaching is complemented by virtual spaces for training offered by educational institutions, such as universities for the development of formal

<sup>&</sup>lt;sup>1</sup> "the project's platform allows for multi-faceted usage: it allows the project to take the forms of peer-topeer learning platform, idea incubation and crowd-sourced ork": http://www.scribd.com/doc/144017510/New-Avenues-of-Democratic-Participation-and-Social-Innovation-The-Interplay-Between-Citizen-Expert-Think-Tanksand-the-Council-of-Europe-in-the-Edger
education (Mikropoulos and Natsis, 2011). This traditionally has been taking place primarily through the so-called virtual platforms or LMS (Learning Management Systems). It is obvious that with years, learning trends have been growing, when the learning possibilities would be increased with the addition of new devices, aims, scenarios and/or uses.

The key question is how the **New Millennium Learners** introduce all these new scenarios? How do they learn? How do they think and see how, where, with who, with, what do they learn?. (Kennedy et. al. 2008; Prensky 2009; European Commission, 2008). We will present some insights on the basis of our analyses of information delivered by the Edgeryders. We focus here on the issue of relation between formal education and learning, informal education and learning and online education and lifelong learning, as the concepts are presented by young people.

# 2. EDUCATIONAL AND LEARNING EXPERIENCES OF THE EDGERYDERS

Not much can be said about the concrete educational paths of Edgeryders. However, their views offer an opinion that school is hostile, limiting force, essentially extraneous in preparation for adult life; where acquired knowledge is not always welcomed either useful for life, even not related with society around them. In some way, a metaphor about having a disease and being at school (for compulsory education at least) is created; a disease that you should have learnt how to overcome. Although, they recognized not being able to advance without some kind of "basic floor" learning basis.

In fact, participants at the platform know and use theoretical approaches and their own thesis for explaining some facts taking place in their lives. They ask themselves whether theory helps you to understand practice or knowing practice helps you to build theory. The traditional dilemma, plus some new thoughts: what happens when your training is made of theory and practice but not in an equal and/or related way?. These comments help us to understand what Learning means for Edgeryders in two opposite ways. Firstly, learning is seen as not related with education and/or teaching (training?) and these last usually are perceived as negative, because do not allow developing you in the natural, "proper" and excitable/interesting/ enjoyable way:

We are learning junkies, because that's how we survived. We managed to learn before the formal education kicked in, through the environments and the peers. Studying sometimes does not provide a learning environment, but a huge amount of data which is not to be confused with learning. (...) Education has its dangers: Get stuck in a subject bubble: when only your fellow researchers can understand what you're talking about. When studying is exciting there is a risk to become biased and to start collective polarisation amongst your fellow collegues/classmates. (K) And secondly, learning is perceived as a pleasant and valued activity (in the whole sense, with all the implications that it has, plus all factors around it) but not the education/training either teaching (itself):

I am comfortable with the idea of learning as a hobby (...) I guess learning is just a great hobby, and if you do it as a hobby you can learn about fascinating things that are difficult to monetize. (Alberto)

Moreover, the teaching method is also questioned because did not offer any kind of interests by students in order to help them to learn (mainly at HEIs). After being in Educational System, they manifest being more fostered to learn. Effectively, it is quite awesome also to check the way in which they describe how they learn and what educational institutions offer them, what resources they use and what kind of social relations are created in order to learn, creating collaborative knowledge, parallel to formal education; enriching, completing this:

Socially, I feel part of a community & we seem to all support each other well. I think the fact that the majority of us are not stereotypical students & have to juggle other responsibilities makes us all quite respectful and encouraging. Everyone seems to have perspective & their eyes on long-term goals, which is satisfying. People are (generally) studying for explicit reasons rather than doing it because it seems like what you're meant to do. (Hec)

There are super helpful (unofficial) Facebook groups as well, running parallel to the course forums. I only bothered looking recently & must have missed out significantly (...) as there's a lot of valuable discussion there (...) Re synchronous contact - for the design modules, there's been a focus on practical skills (...) alongside the more academic, and I haven't felt limited by the tuition format. There have been companion manuals/workbooks to work through (...) and for me the main benefit of this kind of study is that it is self-directed (...) I think it's more valuable to learn these kind of things by trial and error rather than being shown & getting it right first time. Maybe that's just how I learn best but I've been surprised by how well me & my coursemates have got on with "harder" skills. (Hec)

Therefore the topic which is worth noting is the idea of sharing: knowledge, ideas, thoughts and experiences. Even some new practices are arising: co-authorship, collaborative, co-creation. All of them generate a good atmosphere for discussion, creating new perspectives and ways helping to make new projects and proposals, in a job environment highly competitive and were the markets and society establish our individual (as well as professional as personal) pathways, where the rational is more important than affecting dimension, participants at Edgeryders platform talk about "soul", trying to create a balance between states and individuals, the self and the society.

Also, some examples about how to learn on your own (*Do It Yourself, self-learning*) are possible; in this way, it is discussed *self-learning, flipped learning* and *inclusive learning*. Even some ideas about learning in community are given; how they

understand education and learning (learning everywhere and everyplace, from each other, by sharing, interchanging and creating):

But there is time for everything, this is why I'm here, to improve my skills! :) (Florina)

*I really agree that all of us we have to learn how to learn and that we could learn anything (Daniela)* 

It is quite interesting indeed to discover their views about online learning. Besides, the positive values and/or benefits given to studying formal education through internet. What's more, the ideal pattern of online education offered by these participants includes formal and informal learning (official and non-official discourse, tools and methods, but they –both- work):

The use of technology in course delivery & design is pretty innovative, the first course I did won some sort of award for this. Lots of video, audio files, realtime communication, interactive systems (we had an online portfolio/design studio for one, so we could all feed back on each other's work). I think this is a large part of what makes it effective. (Hec)

This leads them to consider online learning as the future for changing Education Paradigm, including it in formal learning, creating what authors called *Personal Learning Environments* (Casquero et. al., 2010):

So are digital learning establishments the future?" If they are the future or they might be a larger part of the future, then the differences between the two models need to be split into those differences necessitated by the model (my concerns for vocational subjects and subjects requiring access to expensive equipment), and those which can be resolved through the application of emerging technologies (socialisation, access to resources which can be virtualised). (Joye)

# CONCLUSION – EDUCATION VS LEARNING OR EDUCATION AND LEARNING SCHEME?

One of Edgeryders Mission was aimed at the problem on how to change Education Paradigms<sup>2</sup> in order to adapt to Digital Society and face learning and educational challenges, reshaping Educational and Learning models. This needs to be added to the concepts of training and what learning were generated thanks to this teaching. Their statements clearly distinguish education from learning and indicate that the formulation of specific competences and skills is made in the environment outside the schooling system. It is like they were disappointed and irritated, that all this effort to cope with educational system and moving up all these levels does not translate simply into a further path in a social life. However, for many participants, learning is a way to develop your mind and personality, but they do not forget the

<sup>&</sup>lt;sup>2</sup> http://edgeryders.ppa.coe.int/reality-check/mission\_case/changing-education-paradigms#comment-1368

social need of job, ... to be train for facing the adult world and as a way for social mobility.

So, learning is understood as the activity of an individual, not necessarily related to school activity. Most of the comments are indeed about acquiring skills (through learning, so person decides) but not thanks to teaching (education, where others are responsible of what you learn). It can be shortly summarized like this: look, how much do I know, but it is not you, who teach me, but I learned it by myself. However, it is not directly reported that the school (as institution) shall be eliminated but also how to flexible it, in better correspondence with "real life". What is proposed is a change of it – to become a place of learning how to learn. This is associated with disrupting education and re-organizing schoolwork, flipping the classroom and changing teachers' role, allowing them to realize individual projects and take personal responsibility in the learning process. One of the most important solutions to solve some recognized problems of educational/learning system is networking and dense social relations, Van Dellen (2013) and Veletsianos and Russell (2013).

On this way the implicit concept of social capital is being brought into the discussion on education and learning. Dense social relations are perceived as a way of gaining required knowledge, skills, and information. This is particularly interesting in the scope of initial interpretation made by Collins and Cuzzocrea (2012) about individualisation of Edgeryders transition processes. In fact, the nowadays concept of social capital, especially by Coleman (1991) and Putnam (2000) can be perceived as a quest for lost community and in entries of Edgeryders we can trace some clues of such sentiment. On the other hand, the strong emphasis has been given to importance of the weak ties, which again brings the concept of social capital developed on the basis of network theory (Lin 2001).

## REFERENCES

- Anderson, J., Boyles, J. & Rainie, L., 2012: The Future Impact of the Internet on Higher Education. The Pew Research Center's Internet & American Life Project, Washington DC, 2012, available at: http://pewinternet.org/~ /media/Files/Reports/2012/PIP\_Future\_of\_Higher\_Ed.pdf (accessed on 16th July 2013).
- Baker, D. P., 2009: *The educational transformation of work: towards a new synthesis*. Journal of Education and Work, 22, 2009, pp. 163-191, ISSN: 1469-9435
- Ball, S., 2003: Class Strategies and the Education Market: The Middle Classes and Social Advantage. Taylor & Francis, London, 2003, ISBN: 0415-27277-7
- Beetham, H., McGill, L. and Littlejohn, A.H., 2009: Thriving in the 21<sup>st</sup> century: Learning literacies for the digital age (LLiDA project), available at:

http://www.jisc.ac.uk/media/documents/projects/llidareportjune2009.pdf (accessed on 1st August 2013).

- Bourdieu, P., 1992: Distinction: A Social Critique of the Judgement of Taste. Harvard University Press, Paris, IBSN: 978-0-415-56788-6
- Casquero, O., Portillo, J., Ovelar, R., Romo, J.& Benito, M., 2010: Strategy approach for eLearning 2.0 deployment in Universities. Digital Education Review, 18, 2010, pp.1-8, ISSN: 2013-9144
- Cobo, C. & Moravec, J., 2011: Invisible learning. Towards new ecology of education. University of Barcelona Press - Laboratori de Mitjans Interactius, Barcelona, 2011, IBSN: 978-84-475-3517-0
- Coleman, J., 1991: Foundations of social theory. Cambridge, Harvard University Press, 1991, ISBN: 978-0674312265
- Collins, R. & Cuzzocrea, V., 2012: 'Edgeryders: facilitating youth transitions to an active life by reinforcing shared social responsibility. A review of the first five months'. Edgeryders Conference ,,Living on the Edge", 14<sup>th</sup>-15<sup>th</sup> June 2012. Council of Europe, Strasbourg. Available at: http://es.scribd.com/doc/85585935/Edgeryders-Facilitating-Youth-Transition-to-an-Active-Life-by-Reinforcing-Shared-Social-Responsibility (Accessed on 3rd June 2013).
- Collins, R. & Farrel, G., 2013: *The Edgeryders Guide to the Future: A handbook for policymakers and managers of policy-oriented online communities*. Council of Europe, Strasbourg. Available at: http://es.scribd.com/doc/116463853/Draft-The-Edgeryders-Guide-to-the-Future-A-handbook-for-policymakers-and-managers-of-policy-oriented-online-communities (Accessed on 28th July 2013).
- European Commission, 2008: *The European Qualifications Framework for Lifelong Learning (EQF)*. Luxembourg: Office for Official Publications of the European Communities. Available at: http://ec.europa.eu/education/pub/pdf /general/eqf/broch\_en.pdf (accessed on 9<sup>th</sup> July 2013).
- Gutiérrez, P. & Mikiewicz, P., 2013: Learning on the Edge. Edgeryders learning and educational experiences. Council of Europe, Strasbourg, available at: http://www.scribd.com/doc/113476764/Learning-on-the-Edge-Edgeryders-Learning-and-Educational-Experiences (accessed on 4th July 2013).
- Hadjar, A. & R. Becker, 2010: Expected and Unexpected consequences of educational expansion in Europe and the US. Theoretical approaches and empirical findings in comparative perspective. Haupt Verlag, Bern-Stuttgart-Wien, 2010, ISBN: 978-3-258-07519-8
- Kennedy, G. E., Judd, A. C., Gray, K. & Krause, K. L., 2008: First year students' experiences with technology: Are they really digital natives? Australasian Journal of Educational Technology, 24, 1, 2008, pp.108-122,

ISSN: 1449-3098

- Lin, N., 2001: Social Capital: A Theory of Social Structure and Action. Cambridge University Press, New York, 2001, ISBN: 978-0-521-47431-3
- Mikropoulos, T.A. & Natsis, A., 2011: *Educational virtual environments: A ten-year review of empirical research (1999-2009).* Computers and Education, 56, 3, 2011, 769-780, ISSN: 0360-1315
- Moravec, J. W., 2008: A new paradigm of knowledge production in higher education. On the Horizon, 16, 3, 2008, pp.123-136, ISSN: 1074-8121
- Prensky, M., 2009: H. sapiens digital: From digital immigrants and digital natives to digital wisdom. Journal of Online Education, 5, 3, 2009, pp.1-9, ISSN: 1552-3233
- Putnam, R.D., 2001: Bowling Alone. The collapse and revival of American Community. Ed. Simon & Schuster, New York, 2001, ISBN: 978-0-684-83283-8
- Van Dellen, T., 2013: Toward a Social Responsibility Theory for Educational Research (in Lifelong Learning). European Educational Research Journal, 12, (2), 2013, 286-300, ISSN: 1474-9041
- Veletsianos, G. & Russell, G.S., 2013: What do learners and pedagogical agents discuss when given opportunities for open-ended dialogue?. Journal Educational Computing Research, 48, 3, 2013, 381-401, ISSN: 1541-4140
- Wild, F., Mödritscher, F. and Sigurdarson, S., 2008: Designing for Change: Mash-Up Personal Learning Environments. eLearning Papers, 9, 2008, 1-15, ISSN: 1887-1542

## IT AS A MANNER OF DEVELOPING SCIENTIFIC THINKING

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Abstract: In this paper, the course of research into different manners of preparing for chemistry classes and their effects of on the students' interest in this subject is described. The students' activity and self-study was considered the key aspect of the innovation referred to as "flip teaching". The study was conducted in the first years of secondary schools. Students participating in the study conducted small-scale experiments as recommended by their teachers, and then uploaded the results and their reflections on a dedicated platform in the form of descriptions, diagrams, videos of experiments and solutions to problem tasks suggested by the teacher.

Keywords: flip teaching, flipped classroom, multimedia, platform, chemistry

### **INTRODUCTION**

The essence of the flip teaching is changing the role of a teacher who not only teaches but also supports learning, not only presents the subject, but also explains it and changing the students' role from passive recipients to active constructors of their own knowledge. Lesson is also altered, it becomes the unit during which students are familiarised with a new content. It is aimed to strengthen their knowledge and solve problems. Environment is also changing \_ from lesson in a classroom to the Internet.

The fundamental idea in flip teaching is to introduce constructivist learning cycle: the search for references in existing knowledge (often colloquial, but also semantic) and external sources, through processing, to systematize, and finally (with the help of a teacher) to build students' categorical system (Cargill, Sanchez 2013).

Developed within the project Sniadeckich College, flipped classroom strategy (Dylak 2012), refers to the theory of constructivism and uses the achievements of science education, psychology, social science, as well as the potential of new information technology. It is an attempt to create an integrated strategy for teaching

and learning. Strategy, which will be a natural consequence of modern, teaching methods the student, appropriate for the digital age.

## 1. THE STAGES OF FLIPPED CLASSROOM STRATEGY

The essence of flip teaching is the active organization of information in the independent process of collecting information, and moreover, searching for references in their current knowledge. In order to understand the material, students using prior knowledge, search information in their memories and experiences that will enable them to understand new material and give it meaning.

The proposed flipped classroom strategy (Dylak, Duda 2011) assumes that the learning cycle consists of three phases: searching for references in students' existing knowledge and external sources, information processing, systematizing and building students' categorical system. Usually students independently collect data, organize it and create information, and then build a personal knowledge on a subject by solving tasks, in order to systematize students' knowledge (Dylak 2012).

Therefore flip teaching is a phased process. For each phase specific actions are assigned, to achieve the planned targets.



Figure 1. The stages of flipped classroom strategy

#### Source: author's materials

It should be noted that the vast majority of the time spent on the thematic issue is related to students' and teachers' performance on educational platform in the digital environment. Thus, apart from the obvious, planned effect – permanent personal knowledge building, it develops and improves skills related to the virtual environment.

Flip teaching was introduced to the Polish educational system in the Śniadeckich College project, as an innovative science curriculum. The project was started in 2010, and in the school year 2011/2012 a project's pilot was conducted at the Holy Mary Magdalene High School in Poznań and Juliusz Słowacki High School in Grodzisk Wielkopolski<sup>1</sup>. Conducted research and observations helped the contents

<sup>&</sup>lt;sup>1</sup> The leader of the Project is the National Foundation for Computer Education (OFEK.pl). The project partner is the Adam Mickiewicz University(amu.edu.pl) with an interdisciplinary team headed by Professor Stanislaw Dylak

of the Science College educational platform on which they are embedded. All the teaching materials: e.g. scenarios, physics, biology, geography and math classes education guide entitled Methodology of flip teaching and 75 films and topics in biology, chemistry, physics, geography and math for the first year of high school classes (Dylak, Gulińska 2013).

After the test phase, a number of meetings were held, attended by head teachers, secondary schools' teachers (high schools and middle schools), representatives of local authorities responsible for education and education, representatives of the boards of education, the teaching staff working in educational institutions, representatives of educational institutions, foundations, individuals interested in education, educational experts and people interested in contemporary education and education in a broad sense. The speakers were those involved in the project.

#### 1.1. Activation (Dylak, Wiśniewska, Leszkowicz 2013)

At this stage, the students, under the guidance of a teacher, choose from a list of interesting topics planned for implementation during the course. It is assumed that during this phase the knowledge possessed by students will be used (news, beliefs, colloquial terms, skills). The advantage of this approach is the use of the student's understanding in accordance with his or her personal knowledge and ideas. Moreover, it activates a personal, not forced from outside, critical reflection. At this stage it is important to identify not the intellectual capacity of students, but their cognitive preferences.

The activation step begins during the first lesson - as to the topics are assigned, and ends at the time specified by the teacher - but no later than a week after the first lesson. The teacher is present at this stage, especially when students summon him or her electronically.

### 1.2. Processing (Dylak, Wiśniewska, Leszkowicz 2013)

At this stage, students use the teaching materials which are indicated or prepared by the teacher. Constant communication between students and between students and a teacher is assumed. Students can, and even should ask the other students and teacher questions. Processing is carried out using the learning platform and should not exceed four days, during which students devote about 60 minutes to work on their own. At this stage, students work independently and/or in groups, in agreement with each other and with the teacher, they filter and organize the collected material. The leading role in the construction of educational resources, which are closely related to the processed issues, is played by students' cognitive- critical activities and teachers' critical-cognitive activities. Students information, questions, proposed answers and assumptions should be the content base for resources associated with the issue – constantly supplemented and expanded.

To encourage students to be active inspiration from the teacher is needed. One way of inspiring students is to order them to create and constantly update individual Web sites and / or thematic notes in an e-portfolio. It is suggested that at this stage the

teacher uses such a tool as Web Quest, which helps organizing teacher's actions and students' reactions.

## 1.3. Systematization (Dylak, Wiśniewska, Leszkowicz 2013)

The third stage, like the first, is carried out in class, in the presence of a teacher. The essential part of systematization stage is preliminary test of knowledge, abilities, issues' understanding and scientific reasoning prepared by the teacher. Creating the test can be also one of the students' tasks to be performed by the students together and under the guidance of a teacher in the digital environment. It is suggested to take the test before the lesson, the teacher could be prepared to comment it and fill the gaps - in the knowledge, understanding, structuring, and interpretation. Thus, the lesson's starting point would be teacher's comments to the test results, as well as answers to students' questions.

At this stage, the students organize information gained during the activities undertaken whilst processing time. At the same time students also build their own cognitive schemes and place them in the system of the concepts they already knew, operations, assertions and beliefs, according to certain educational goals, selected by the teacher's in connection with established taxonomy purposes.

## 1.4. Evaluation (Dylak, Wiśniewska, Leszkowicz 2013)

During the evaluation stage students engage their knowledge as judges, critics and reviewers, making judgements about their work and achievements – such as what could be added or what sources have been forgotten, how to organize their work better in the future. What changed in students' knowledge during dealing with certain topic – for example, I knew that, now I know this, or now I know it differently ... Students practically use critical assessment skills acquired during a lesson in the classroom.

Assessment is measured based on criteria established in consultation with the students. Final rating issued by the teacher based on a students' participation in lessons and the content developed on their websites – is final. The evaluation is carried out on the educational platform and takes about 15 minutes.

# 2. FLIPPED CLASSROOM STATEGY DURING THE CHEMISTRY LESSONS

All scheduled in this way classes, including the chemistry course, in addition to typical mathematical, scientific and technical research skills are aimed to shape a number of other key competencies, such as communication in the mother tongue, digital competence, learning how to learn, social skills, initiative and entrepreneurship (Gulińska, Bartoszewicz 2011).

The activation step in the scenario of chemistry lessons conducted using the flip teaching includes student's objectives, detailed student's and teacher's actions and

activities as well as information on the student's work conditions including the timing and the form of communication with the teacher and other students.

The same stage in student's materials includes notes and tasks formulated by the teacher. Their goal is to inspire students to use multiple sources of knowledge, for example: own thoughts and judgements, colloquial opinions, other sources of popular science, textbooks, and encyclopaedias.

Materials for the teacher on the activation level are mostly the description of the activation presentation relating to individual modules' content.

**Reviewer:** Units designed for teaching chemistry using flip teaching offer pupils a variety of activity opportunities, also in the digital environment. Students can work individually or in a group, they can communicate with each other and with the teacher. A variety of working environments and consistent teaching materials are conducive to the activity of the students, such as analysing, summarizing, checking and reasoning.

For the purpose of these activities PowerPoint presentations and educational films corresponding to issues mentioned in the classroom were prepared. Especially educational films were proven valuable to raise students' activity working alone at home.



Figure 2. Frames from the film "You have to eat to live" which inspires students to take action

Source: The film "You have to eat to live, educational platform

**Processing step** in the scenario of lessons conducted using the flip teaching includes student objectives, detailed student activities and teacher activities, as well as additional guidance for teachers on compliance with health and safety regulations, and tips for performing and documenting the experiment by students in the "PHOTO" section. There are also tips on how to solve the problems associated the students' subsequent tasks. Again, the tasks for the students which the teacher can publish on educational platform were proposed.

Processing stage in the student's materials includes theoretical and experimental tasks' description. The results of these tasks the student shall publish on the platform in the form of so-called portfolio at the place and time specified by the teacher. It is suggested that the results of experimental work is illustrated by the self-taken photos or short films, which is particularly interesting and inspiring (even slightly weaker students) proposal. The student receives information about the possibilities of

developing their knowledge, for example, based on Internet resources (Böhmová, Šulcová 2007).



**Figure 3. Sample student's photo placed on the platform** Source: Educational platform

Materials for the teacher on the processing stage refer to the materials in the scenario and materials for students. There are theirs supplementation and development. They contain valuable suggestions for teaching on the interpretation of certain phenomena, and above all include students' tasks solutions with additional methodological guidelines.

**Reviewer:** Materials are in line with the current state of chemistry knowledge, and their layout and procedure promote the development of logical thinking and interest in chemistry and its practical applications. Materials are mainly addressed to the teachers involved in their work and will be an important part of education reform, which in the curriculum for the first year of high school establish new hours scheme for all subjects, and in addition quite revolutionary system of content when talking about chemistry.

Bearing in mind the guidelines written in the new core curriculum as a starting point for the project in the field of chemistry student's experiment was established. It was assumed the work will be based on the activities in a home laboratory in a small scale CSS (Chemistry in the Small Scale). Each student receives a laboratory set which contains the elements needed to perform experiments recommended by the teacher in order to complete the activation phase. These experiments are performed according to its description, documented on a video or by taking photos which are later placed on the platform. Moreover students writes down his or hers observations on the worksheet.



Figure 4. In the small scale set's elements Source: Educational platform

CSS technique allows to perform many classic experiments from various spheres of chemistry. Using simple equipment in a small size and very small quantities of substances increases the safety of the experiment, reduces the time during which it was carried out and allows to create a more detailed description. The main advantages of this experiment are: increasing the safety of the experiment, intuitiveness and ease of use of equipment, the ability to perform experiments at home, significantly reducing the amount of post-reaction waste, performing experiments impossible to perform in a standard scale, easiness and quickness of experiments' preparation, individual exercises, increasing student's motivation.

**Reviewer:** Particularly noteworthy are experiments performed in the small-scale innovative technology and recorded independently by the student at home. They allow modern, activating and experimental approach to the teaching of chemistry. The proposed learning cycle includes over 30 interesting and easy to perform experiments that will contribute to sustainable consolidation of the content.

To summarize student's research activities a package of interactive tasks was prepared. They are always in line with the presented issue, performed experiment and they show the attractiveness of the teaching process. Tasks appear on the platform only after the student carried out an experiment using CSS technique, what should be an additional incentive for students. The set of the interactive tasks prepared for each unit require student to identify the content of the tubes based on the observation of the experiment. Selecting the one of proposed samples is followed by mixing the contents of test tubes, so that the user has the opportunity to observe the reaction. Subsequent attempts allow students to carry out all the experiments and determine the substrates, which were used for the study.



Figure 5. An example of a task in a virtual lab Source: Educational platform

**Reviewer:** These tasks can meet the following learning objectives:

- practice skills in the use of information technology;
- stimulating students to repeat information in an unconventional way;
- preparing to perform an experiment in a laboratory;
- preparing to conduct analytical studies;
- develop skills of logical reasoning;

- improvement of analysing the content of the command;
- preparation for media monitoring and evaluation;
- self-assessment of skills.

Relying teaching on chemical experiment and making education similar to the a research process is one of the indisputable advantage of the reviewed materials.

**The systematization phase** in the scenario of a lessons conducted using flip teaching contains a lesson plan with standard stages such as organization part, repetitive part, relating part, progressive part and summary part. Planned teaching materials, which greatly facilitate the work of the future users are also described.

This stage in the materials for students contains tips on how to complete your notes in an e-portfolio and additional homework relating to the course (including the tasks for volunteers).

Materials for teachers at systematization stage refer to the materials in the scenario, and materials for students. This part of the materials for the teacher will be particularly valuable for him. They contain a detailed lesson plan for the classroom, especially information that searched by students at home, a description of the experiments that can be performed by a teacher, student's experiments, drawings proposal, diagrams, additional arithmetical tasks, crosswords, chemistry graphs, suggestions for homework.



Figure 6. The proposal of the teacher's demonstration in the classroom

Source: Educational platform

**Reviewer:** All experiments, both those performed and documented independently by the student at home (using a personal, dedicated, experimental project set), and the experiments carried out in the classroom with a teacher participation, are described both in the scenarios of lessons, as well as in the support materials for students and methodological materials for teachers. Simple and safe experiments shape students' research interests and directly influences on the increase of the students' interest in the subject.

**Evaluation stage** closes the cycle of learning in the area of each of the 15 modules. Written lesson materials for students and teachers assume the participation of all students in project's summarizing and evaluation. Students are able to decide about their work and achievements. Teacher also asses, but only in consultation with the students and using the criteria developed jointly with them. The proposed evaluation forms are very diverse, they activate students, interact with their emotions and

trigger their engagement. The innovative forms of evaluation include: (\*) after the class - establishing the forum thread - It made me curious ... (\*) examining the quality of resources in the tab *Voting for the best materials*. Students' and teachers' actions planned as above will result in objective feedback and that can be used it in the future.

**Reviewer:** The authors of each unit presented a description of the procedures for reaching goals. There is a variety of questions, tasks, theoretical experiments performed and recorded independently by students at home, experiments carried out with the participation of teachers in the classroom and interactive task. What should be noted is the fact that it show chemistry as an experimental science, especially in the area known by students from the everyday life. In the created by the authors of chemical experiments, there is whole set of experiments recommended at this stage of education.

All units and additional materials are deposited on the platform, from where they can be downloaded suitably to ones needs.

## CONCLUSION

Flip teaching is based on the prepared materials (scenarios for the student containing descriptions of all planned tasks, tests, scenarios for teachers containing descriptions of the solutions of tasks and tests) providing students with opportunities to complete various tasks, including using resources prepared by the students and the teacher in the digital environment. Students can work individually or in a group, can communicate with each other and with the teacher. A variety of work environment and consistent teaching materials are conducive to the students' activities, such as analysing, summarizing, checking and deduction (Barseghian 2010).

#### Students' comments:

- Independent search of different information before the lesson makes it easier to understand the content presented in the classroom.
- It was interesting to use chat or forum to share experiences with the classmates and the teacher. You could upload the photos from the experiments and links to other web sites.
- Frequently we found information on the Internet, but sometimes it turned out that our responses were mistakes, which is why we chose websites with endings: edu, gov.
- Experiments carried out at home were mostly an interesting adventure, but for the moment we felt like scientists. Performing an experience made it easier to remember information. Photo story took a lot of time, but the result gave much satisfaction and positive effect on the final grade.

- During the discussion in the classroom about the tasks with whom we had trouble (done in preparation for classes in your home, complementing its portfolio) it was easy to understand where we made mistakes.
- Tasks in the virtual lab were great. This type of tasks allow you to test your knowledge in practice.
- Test mobilized us to work independently. However, the assumption that you had to be available on the platform the day before class at a certain time sometimes complicated my life.
- Using the platform, while solving the tasks sometimes consumed too much time. But thanks to the lessons we do not have to take notes and we were able to engage in a lecture.
- At the beginning of self-assessment was a difficult task, but with time it become quite easy.

A teacher working in pre-school system: Student while looking for answers independently, or thinking about the problem presented by the teacher develops creative thinking, is engaged in learning, and moreover he or she understands and remembers the content. Often before students answered the question on the platform, they consulted each other, discussed the problem – what improved their relationship and contributed to the integration of the class. By on dependently performing chemical experiments in the small scale, students had the opportunity to discover the nature of the researcher in themselves. These experiments gave students a lot of fun, increased interest in the subject, even though there were those who complained about cleaning up after the "home" laboratory classes it took them a long time. It turned out that this way of building their own knowledge, less gifted students new possibilities to demonstrate their initiative, as well as capacity utilization manual. Implementation of these activities resulted in their greater commitment to the lesson and, in consequence, in better grades.

#### REFERENCES

- Barseghian, T., 2010: Students Learn in Class, Think and Discuss at Home, KQED, November 19, 2010
- Böhmová, H., Šulcová, R., 2007: *Chemistry Experiment in Distance Education* Problems of Education in the 21st Century PEC 2007, 2 (2)
- Cargill, M., Sanchez, D.M., 2013: *Flipped School*, In: Informatics in Education, Toruń, pp. 23-25 [In Polish]
- Dylak, S., Duda, L., 2011: The implementation strategy of Collegium Sniadeckich, Poznan

- Dylak, S., 2012: Methods of training in flip teaching strategy, collective work, a text book co-funded by the European Union under the European Social Fund, Poznan
- Dylak, S. Wiśniewska A., Leszkowicz M., 2013: *The strategy of preemptive education: the Teacher as the Architect of a Student's knowledge* In: Informatics in Education, Toruń, pp. 26-34 [In Polish]
- Dylak, S., Gulińska H., 2013: Advance Learning Strategy: *the Teacher as the Architect of a Student's knowledge*, 10<sup>th</sup> IFIP World Conference on Computers in Education, Toruń, pp. 142-143
- Gulinska, H., Bartoszewicz, M., Makles, G., Mischke, K., 2011: Scenarios for Chemistry classes in line with flip teaching – Collegium Śniadeckich, Department of Chemical Education, Poznan
- Collegium Śniadeckich: *About the Project, 2012, Available at* www.kolegiumsniadeckich.pl and www.ofek.pl (Accessed on 10 February 2013)

## INFORMATION LITERACY TRAINING IN HIGHER EDUCATION AS AN INTRODUCTION TO LIFELONG LEARNING. THE NEEDS OF THE CURRICULUM REFORM

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Abstract The article discusses the need to modify the curricula of ICT in higher education. Contemporary university students seem to function well in the world of new technology, however, they have problems when working with information, including the identification of information needs, the selection of search tools adequate to the task and evaluating information found on the Internet. The curriculum of ICT at universities very often focuses only on narrow technical aspects. There is a necessity to introduce a broad perspective covering the organization, planning and implementation of individual learning in a digital information environment. It is a very important part of the development of the information culture of the young generation and lifelong learning process.

Keywords: information literacy, information literacy training, ICT, information culture

#### **INTRODUCTION**

Effectively using the digital information environment is key in the process of learning. It does not only concern formal learning, taking place at every level of general and higher education, but also, or even most of all, the process of self-learning in the context of lifelong learning and the requirements of the market.

The moment of graduating from high-school and going to college is especially important. Studying at a college is a time when young people take responsibility for their personal education. During primary and high school it is the teacher who is the supervisor. He is responsible for the entire didactic process, he bears the responsibility for organizing the learning process, providing sources, textbooks and learning aids. A very important role of the teacher at higher education levels is preparing students for taking initiatives and organizing independent learning. The goal of academic institutions is to build curriculum for an individual learning process of the students which facilitates taking responsibility for their own professional development. The learning process is holistic and as a lifelong activity cannot be limited to school and institutionalized forms of learning, it has to break these boundaries and teach critical thinking as well as solving real problems (Information Literacy Competency ..., 2000).

## 1. INFORMATION LITERACY IN THE LEARNING PROCESS

In order to fully use the rich technological potential in the learning process and to efficiently move around the digital information space it is necessary to acquire the appropriate training to work with such information, which may come in different forms. This training should include a broad-spectrum of information competences.

### 1.1 Standards of Information Literacy Competency

Information literacy is defined as a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information (Information Literacy Competency ..., 2000; American Library Association, 1989). For the purposes of the higher education institutions certain standards have been established - standards for information literacy which modern students should have in today's knowledge society (The SCONUL Seven Pillars ..., 2011; Information Literacy Competency ..., 2000).

Among the most important information competences in the process of learning and teaching at the academic level are:

- 1. searching for information in available resources:
  - a. identifying potential sources of information and understanding the specifics (using different data formats);
  - b. familiarity with basic and advanced search tools (popular search engines, Internet catalogs, public databases, resource catalogs in Deep Web, etc.);
  - c. ability to use the search tools in a practical and efficient manner (using proper key words, using advanced search options limiting the search field);
  - d. building and implementing search strategies adapted to the search topic and discipline (using and combining specialized search tools to locate the needed information);

- e. using content aggregating systems (feeds and RSS readers) to find current data, follow information published within a specific discipline or issue;
- f. verifying the authenticity, topicality and reliability of the obtained results critical assessment of the obtained information and its sources;
- 2. managing the content organizing, categorizing and ordering information;
  - a. archiving information (creating own information resources, bookmark lists and link to articles, web pages, databases etc.);
  - b. tagging (creating a system of personal tags, using the Social Bookmarking service);
  - c. using applications and services for managing works cited (Zotero, EndNote), creating databases of personal resources, organizing, creating theme catalogs, automatically downloading information form works cited databases, creating quotes and note databases;
- 3. presenting and publishing obtained information and self-studies
  - a. shaping the information in a form suitable for the situation text, visual, multimedia,
    - proficiency in using text editing software, spreadsheets and software for preparing multimedia presentations;
    - using image editing software and applications for audiovisual editing;
    - creating web pages, keeping a blog, using it for managing content (creating a personal e-portfolio), publishing self-prepared content on web pages and blogs;
  - b. familiarity of the legal aspects of the availability and using information resources (content protected by copyright, such as Open Content);

4. communicating and sharing content with other participants of the learning process;

- a. using basic communication tools (e-mail, Internet communicators, VoIP services);
- b. participating in discussion groups and forums or commenting on web pages and blogs;
- c. being part of a team in a virtual environment (Google Documents, Zoho, SkyDrive, videoconferencing software, etc.).

### 1.2. Visual Literacy Competency Standards

One of the elements supplementing information literacy are visual competences which facilitate unimpeded exploration of the intricacies in the contemporary

communication-information systems. Developed in the form of standards for Higher Education (Visual Literacy Competency Standards for Higher Education, 2011) in the academic and science environment (The Association of College and Research Libraries, ACRL) were defined as a set of abilities which facilitate efficient searching, reading, interpreting, assessing, using and creating images. They supply the learner with tools which enable to understand and contextually analyze the visual cultural space based on ethical, aesthetical, intellectual and technical elements engaged in creating and using visual materials. The student, supplied with visual competences, is both a critical consumer of visual media and a competent participant of the information culture in the field of visual knowledge. Visual literacy are specific results of learning aimed at helping the students in undertaking efficient work using visual materials at the academic level. It should be based on the ability to use, share and create visual materials and raise the aesthetic and legal awareness of sharing and spreading visual information. In this form Visual literacy is one of the elements of the information competences of the contemporary society which combines information skills, interpreting, culture and visual communication with technical abilities in the field of using digital media (Visual Standards 2011, Wieczorek-Tomaszewska 2013).

#### 1.3. Information competences and key competences

Among the eight key competences distinguished by the European Union which combine knowledge, ability and attitude considered necessary for the purposes of self-realization and development, being an active citizen, social integrity and employment, the information competences were mentioned next to the ability to learn. Information and communication technologies are considered as an important element of school education and are classified in the category of cross competences with an interdisciplinary character, so that they can be taught in parallel as a separate subject or constituting an interdisciplinary learning program (Rozwijanie kompetencji (*Developing key competencies*)..., 2013). This interdisciplinary status is scarce when implementing ICT topics and teaching information competences at the academic level.

### 1.4. Lifelong Learning and creating a personal learning environment

Currently, efficient moving around the dynamically developing digital educational content is determined by information competences. They are also a foundation for building a personalized educational environment.

Personal Learning Environment (PLE) is creating an individual establishment which functions as a system for organizing content and a network of social contacts from a learner's perspective, not from the perspective of a group or an educational institution. It is due to the process of learning which takes place in different contexts and situations and is connected with a raising awareness of the importance of informal learning. The concept is used for learning at home, school and workplace by solving problems or interacting with others; the key factor being choices, preferences and motives building the environment (Downes 2009, Kompen,

Edirisingha, Mobbs 2008, Pulak 2012). Other educational environments, through effortless updates and modifications, can play an important role in lifelong learning, especially with the dynamically advancing IT environment we face the need to constantly improve and acquire new IT skills.

Information competences can be viewed from a narrow and broad perspective. Narrowing down, they can be seen as a set of specific skills or features. From a broader perspective and a more complex approach the information competences can be seen as mutual relations and interactions, occurring between the information space and its user. In this field they include not only the knowledge of information and a set of skills but also a way of learning, an approach to learning that incorporates various aspects of information culture, conditions, contexts and styles (Bruce, Edwards, Lupton 2006).

## 2. THE NEEDS AND CURRENT STATUS IN THE FIELD OF ACQUIRING INFORMATION COMPETENCES IN LIGHT OF OWN RESEARCH

## 2.1 Goals, issues and methodology

The goal of the research was to diagnose the needs for the learning content implemented as part of the subject (course) *Information Technology* conducted by the students of pedagogical faculties.

What content type and scope, according to the respondents, should be part of the *Information Technology* course at pedagogical faculties?

How do the students assess their skills in the field of IT?

What is the share of using ICT in self-learning?

The research used an Internet survey which was available from October 2012 to January 2013. There were 228 filled forms in total. The research group included first year students of the pedagogical faculties on full-time and part-time studies at the Jesuit University Ignatianum in Cracow and the Pedagogical University of Cracow.

## 2.2 Research results

The results show great variety of needs among students. The most sought needs were related to ICT which would be helpful in future employment, including basic utility software. The topic of copyrights and license, especially in relation to typical educational activities was raised, for example using didactic materials (including multimedia) based on network resources, publishing and sharing such materials with students, etc.

Respondents assessed the role of school rather negatively in shaping Information Technology competences; 44% respondents stated that school did not prepare them or prepared very poorly (Figure 1).



# Figure 1. The role of formal education in shaping Information Technology competences





Figure 2. The role of self-learning in shaping Information Technology competences Source: own research

However, a much bigger share was in the field of self-learning attitudes Over 40% of the respondents admitted that they gained their IT skills through self-study and personal experience (Figure 2).

The respondents were asked to assess their skills in specific fields. The list of obtained assessments is in Table 1.

#### Table 1.

ICT fields	Low	Average	High
Editing and formatting texts (footnotes, tables, styles, automatic table of contents, signatures, etc.)	28%	63%	9%
Preparing multimedia presentations	11%	66%	23%
Making calculations and preparing lists in the spreadsheet, developing data in the form of graphs	39%	58%	3%
Using databases	64%	34%	2%
Designing and implementing web pages	83%	12%	5%
Effectively using search engines and Internet catalogs and other tools used in search for information	8%	50%	42%
Preparing graphic materials (image editing, preparing own work in popular graphic editors)	32%	54%	14%
Preparing audiovisual materials, recording and publishing videos and online recordings (YouTube)	65%	32%	3%
Social and legal aspects of the availability and using information (familiarity with copyrights, software licenses and content sharing)	68%	28%	4%
Socio-psychological phenomena related to using new electronic media (determined by using the computer and the Internet, safety and violence on the Internet, the specificity of electronic communication)	24%	59%	17%

#### Self-assessment of skills in individual fields of ICT

Source: own research

The list of programs designed for editing, presenting and processing data usually used by respondents is in Table 2.

#### Table 2.

Program name	Percentage of users			
Office programs				
Microsoft Word	91%			
Microsoft PowerPoint	74%			
Microsoft Excel	36%			
Microsoft OneNote	4%			
Microsoft Access	5%			
Writer (OpenOffice)	18%			
Impress (OpenOffice)	4%			
Calc (OpenOffice)	4%			
Works	5%			
Programs for multimedia editing				
Picasa	55%			
Photoshop	14%			
Adobe Premiere Elements	14%			
Gimp	11%			
Corel Draw	5%			
Audacity	3%			

The most frequently used utility software

Among the programs used by the respondents on a daily basis is the Microsoft Office Suite which ranked first place (49% of the respondents used the 2007 version, 33% used the 2010 version, the rest used older versions or similar products.) Using different versions of the software at the university by the students proved that they often were not fully satisfied with the ICT course. The software used most frequently by the respondents is shown in Table 2.

#### Table 3.

#### Activity and Internet service which the respondents used

Type of service / Never activity	Sporadically (less than once in a month)	Frequently (once a week)	Very frequently (every day or almost every day)
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Source: own research

E-mail	0%	1%	35%	64%
Internet communicators (Skype)	13%	42%	18%	27%
I use tools for group work (Google Drive)	22%	41%	30%	7%
Social networking sites (Facebook, Nasza Klasa etc.)	2%	7%	8%	83%
Forums and discussion groups	25%	43%	29%	3%
I comment the content published on the Web	28%	27%	32%	13%
I read Internet magazines	38%	42%	16%	4%
I publish photos, create online albums	17%	51%	22%	9%
I watch movies on the Internet	5%	34%	46%	15%

Source: own research

Despite focusing on individualization, the learning process does not take place in isolation; the interaction with other individuals has significant value for its proper functioning. For communicating with other participants of the learning process traditional services may be used, such as e-mail, Internet communicators, chats, VoIP services, for example: Skype, groups or discussion forums. The usage level of communication tools by the respondents is shown in Table 3.

The respondents used team-work tools very rarely, for example Google Drive which facilitates not only online document editing but also effortless sharing of content with other web users - the participants of the learning process.

Currently, the social networking sites, such as Facebook, are the primary means of communication and sharing learning-related content. It is the development of Web 2.0 tools which became the key factor in popularizing the idea of a personal learning environment. One of the main advantages of the used technologies is their simplicity and flexibility. They do not require advanced IT knowledge, they can be easily used for gathering information and publishing personal content on the Internet, for learning from or with other users who have similar educational goals.

The research indicated low interest in creative skills among the respondents, such as managing personal web pages, co-creating and editing websites (5%), keeping a blog (13%), publishing videos on sites such as YouTube, for example I have my own channel (9%). Such lack of need for professionalism among students corresponds to the general lack in competences.

## CONCLUSION

Currently, the implemented courses in the field of IT at pedagogical studies are seen as not completely adequate by the respondents to the requirements set by the digital multimedia environment, in which man functions on a daily basis.

The scope of the content and the organization of the topics related to information literacy at pedagogical studies requires a much higher level of individualization of the learning programs which would suit the needs of a specific student. Individualization should incorporate goals, content, form and methods of the didactic process. Young people starting at a university represent a diversified level of knowledge and skills. In order to level these differences it is essential to create a virtual learning environment which will allow for implementing individual learning goals with the help Internet resources and services. It would be advised to use the blended learning model more extensively and to develop a learning evaluation system which will allow for assessing individual differences.

Similarly to the lower stages of learning, the information competences should be implemented in the interdisciplinary form which incorporates a versatile scope of knowledge that constitutes the contemporary potential of the information culture.

## REFERENCES

- American Library Association. Presidential Committee on Information Literacy. Final Report, American Library Association, Chicago, (1989), available at http://www.ala.org/acrl/publications/whitepapers/presidential, (accessed on 10 August 2013)
- Batorowska, H., 2013: From information literacy to information culture. Reflections on the maturation of the information. Publisher SBP, Warszawa 2013. [In Polish]
- Bruce, Ch., Edwards, S., Lupton, M., 2006: Six Frames for Information literacy Education. Vol. 5. Issue 1, available at http://www.ics.heacademy. ac.uk/italics/vol5-1/pdf/sixframes\_final%20\_1\_.pdf, (accessed on 13 April 2013)
- Downes, S., 2009: *New Technology Supporting Informal Learning*. 25 April 2009. Half an Hour – blog, available at http://halfanhour.blogspot.com/search?q=ple, (accessed on 10 August 2013)

- Information Literacy Competency Standards for Higher Education. Association of College and Research Libraries (ACRL) (2000). American Library Association. 50 East Huron Street, Chicago, IL 60611, available at http://www.ala.org/acrl/standards/informationliteracycompetency, (accessed on 13April 2012)
- Kompen, R., T., Edirisingha, P., Mobbs, R., 2008: Building Web 2.0-Based Personal Learning Environments – a Conceptual Framework. Presented at the EDEN Research Workshop. Paris, 20th to 22nd October 2008, available at https://lra.le.ac.uk/handle/2381/4398, (accessed on 13April 2012)
- Pulak, I., 2010: Personal Learning Environment in practice, or how to design their own digital learning environment.in: Human Media Education. Ed. J. Morbitzer. KTiME UP, Kraków, 2010, available at http://www.up.krakow.pl/ktime/ref2010/pulak.pdf, (accessed on 22 August 2013) [In Polish]
- Pulak, I., 2012: Design a personalized learning environment as part of information literacy. In: Information literacy. Cultural and educational determinants. "Bibliotheca Nostra" Silesian Science Quarterly. No. 2 (28) 2012, s. 78-99, 2012. ISSN 1734-6576, e-ISSN 2084-5464, available at http://www.bibliothecanostra.awf.katowice.pl/, (accessed on 10 August 2013) [In Polish]
- Developing key competencies in schools in Europe: challenges and opportunities for education policy. Eurydice report, Foundation for the Development of the Education System, Warszawa 2013, available at http://www.eurydice.org.pl/sites/eurydice.org.pl/files/Developing\_Key\_Compet ences\_pl.pdf, (accessed on 10 August 2013) [In Polish]
- *The SCONUL Seven Pillars of Information Literacy*, Core Model For Higher Education (2011), Working Group on Information Literacy, available at http://www.sconul.ac.uk/groups/information\_literacy/publications/coremodel.p df, (accessed on 13April 2012)
- Wieczorek-Tomaszewska, M.,: Visual Competence of 21 century in the context of contemporary educational needs (2013), Jagiellonian European Forum in Krakow, 2013, ISSN 2082-8896 [In Polish]

## USING ACTIVE E-LEARNING TO ACCOMMODATE THE NET GENERATION OF LEARNERS

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Abstract: This paper explores some of the active e-learning ideas and considers elearning as useful or even main method of learning in the future.

On the one hand, this question is not so much technical question as educational; on the other hand, change of technologies is an important element in educational changes.

Nowadays, students are different from students of previous years. This is why, educators are faced with the challenge of adapting their teaching styles to accommodate a new generation of learners. Usually, such young people are considered like the Net Generation, Millennials, Generation Y, Digital Natives, Trophy Kids etc; and they do not have the same learning expectations, styles, and needs as former students.

This article assists educators in teaching the Net Generation by highlighting their characteristics and providing examples of how to adapt teaching strategies by using different e-learning tools for active learning to foster student interaction in elearning. The difference between active and passive e-learning is observed, and importance of both strategies usage is argued.

**Keywords:** Net Generation, Eight Norms of the Net Generation, e-learning, active and passive e-learning.

#### **INTRODUCTION**

According to the Generation Theory, there are Four Generations of population cohorts (Schroer 2008).

Scientists try to describe all the generations of XX century – in order to give them names and description.

Understanding differences between the generations is fundamental in constructing of successful learning-teaching process. For each generation there is particular experience characterized by specific preferences, potential, capacity, opinion, and learning style.

Brief chronological classification of generations is provided below.

- 1. Traditionalist (1925-1945);
- 2. Baby Boomers (1946-1964);
- 3. Gen X (1965-1980);
- 4. Gen Y, Millennial, Net Generation (1981 and later).

Modern scientists have identified Gen Z (after 2000) as further group of population cohorts. This article focuses on the fourth group (Gen Y). The main reason for this is belonging of modern students to this cohort.

Usually, such young people are called as - Net Generation, Millennials, Generation Y, Digital Natives, Trophy Kids etc.

A great number of scholars such as Don Tapskott, Diana G.Oblinger, James L.Oblinger, Marc Prensky, Kassandra Barnes, Raymond C. Marateo, S. Pixy Ferris, and Carole Barone etc. state that the Net Generation students don't have the same learning expectations, styles, and needs as former students.

"The current model of education is not appropriate for kids who have grown up digital world and are accustomed to interacting with people, not just to listening. The early educational model might have been suitable for the Industrial Age, but it makes no sense for the digital economy, or for the new generation of learners. We should change the education system to make it relevant for them" (Tapskott 2009).

This article assists educators in teaching the Net Generation by highlighting their characteristics and providing examples of how to adapt teaching strategies by using of different e-learning tools for active learning to foster student interaction in e-learning. We also observe the difference between active and passive e-learning and argue importance of both strategies usage.

## 1. WHY E-LEARNING?

According to (Tapskott 2009), we highlight Eight Norms of the Net Generation:

- freedom,
- customization,
- scrutiny,
- integrity,
- collaboration,
- entertainment,
- speed,
- innovation in today's world.

It was found that half of these norms comply with the principles and foundations of e-learning (Figure 1).

*The first rule is freedom.* Students and teachers get entirely new roles due to elearning. On the one hand, the main role of the teacher is to guide the students. It looks very similar to classic learning, but the difference is following: a teacher should not teach, his/her function is to help, direct, and supervise. On the other hand, a teacher has to update his/her knowledge in the area of modern information technology and using this in the learning-teaching process.

All the stated above is related to setting the needs of students. Thus, students get the necessary freedom in studying, a big boss is removed from learning process and replaced by a mentor.

E-learning allows students to freely schedule their studying process. Students get possibility of flexible selection of what, when, and where to learn. They choose rate, place, and educational trajectories. They also choose alone what they want to study. These points are also related to the second rule.





Source: Own elaboration based on Eight Norms of the Net Generation

The second rule is customization.

Students create personal learning environment via e-learning. They customize technology to their liking, make individual setting and often use avatar. Whereas

before using of avatar, we get the anonymity of interacting in the virtual world of personal learning environment. Using of a programmable avatar often enables individuals to communicate and express themselves in the new ways. Thus, they feel more confident and can obtain better learning results.

One more important rule is innovation.

The Net Generation students stoutly and easily "speak the language" of technology. This emphasizes the importance of modern information technology usage in the learning-teaching process.

As noted in (Prensky 2001), today's students represent the first generations to grow up with this new technology. Author calls them Digital Natives because they have spent their whole life surrounded by and using of different tools of the digital age such as computers, laptops, tablets, smartphones, e-books, digital music players, video cameras etc. Digital Natives have mixed their online and offline life.

In contrast to them, the author highlights those (Digital Immigrants), who were not born in the digital world, but became fascinated by and adopted many or most aspects of the new technology. This draw attention to the fact that the biggest problem of education today is that our Digital Immigrant instructors (who speak the outdated language) are struggling to teach population that speaks entirely new language.

Another striking characteristic of Net Generation students is speed.

When speaking about young people, we usually say 'They want it right now'. This means these people want to learn quickly, in particular, specific practical knowledge. They need quick access to training materials, and e-learning tools can accommodate this.

Net Generation students also expect quick online professors answers, but many professors often have no time or interest to do this (Roos 2012). Communication tools via e-learning are really effective. We can increase student participation and engagement in the learning-teaching process by using such tools. Also we can get feedback on student learning.

# 2. OTHER SIGNIFICANT NORMS OF THE NET GENERATION VIA USING DIFFERENT E-LEARNING TOOLS

Other Norms of the Net Generation do not exactly go with the principles and foundations of e-learning. But in fact, they can be completely realized via using different e-learning tools.

A list of rules and e-learning tools related to these rules are provided below.

Above all things, Net Generation students are excellent *collaborators*. They are natural at networking and like to work in teams. For the Net Generation, collaboration can occur in the same classroom or with team members across the

world. They feel comfortable starting and maintaining online relationships and becoming "good friends" with people they have never personally met (Roos 2012). We must remember that working together is not cheating in their world.

Many teachers lay emphasis on using Web 2.0 tools or social software within their organizations for improved collaboration and innovation (Figure 2).

The list provided below contains examples of freeware tools to each group.

First group includes different learning systems and tools. The classification of such systems is presented in Figure 2.

It is important to keep in mind that modern projects offer free courses online for anyone. An example of such a project is Coursera. This project try to connect people to a great education so that anyone around the world can learn without limits. More information can be found here www.coursera.org.

Second example of such a project is OpenCourseWare (OCW).

OCW is a web-based publication of virtually all Massachusetts Institute of technology course content. OCW is open and available to the world and is a permanent MIT activity. More information can be found here http://ocw.mit.edu.



Figure 2. Collaboration tools via e-learning Source: Own elaboration

#### Other examples are in (Table 1).

## Table 1.

Name of tool	Examples of freeware tools	Description	Link
E-learning system	LMS Moodle	It is a Free web application that educators can use to create effective online learning sites.	moodle.org
Forum, chat	Embedded elements of Moodle	Communication tools	moodle.org

#### Collaboration tools via e-learning. E-learning system

Source: Own elaboration based on data gathered from related sites

Net Generation students are active "global citizens". They usually take participation in the international study and service projects. Some e-learning tools help them to provide good communication and collaboration with foreign students (Table 2).

#### Table 2.

Name of tool	Examples of freeware tools	Description	Link
Group Communication	Google Groups	Google Groups is a free service from Google Inc. that supports discussion groups, including many Usenet newsgroups, based on common interests	groups.google.com
Collaborative Writing	Google Docs	Google Docs, Sheets, and Slides are productivity apps that let you create different kinds of online documents, work with them in real time together with other people, and store them in your Google Drive online	docs.google.com
Whiteboarding	Lino	App helps create a group and share canvases and stickies with other users.	en.linoit.com
Shared Application	LearningApps	LearningApps.org is a Web 2.0 application, to support learning and	learningapps.org

#### **Collaboration tools via e-learning. Examples 2**
		teaching processes with small interactive modules.	
Remote Desktop Control	Chrome Remote Desktop	Access to other computers or allow another user to access to your computer securely via the Internet	chrome.google.com

Source: Own elaboration based on data gathered from related sites

It was previously mentioned about such characteristics of Net Generation of learners as their multitasking skills and short attention spans. These people were grown up online; and now they can at the same time be in social networks, do homework, talking on the phone and use an instant messenger, since they ignore anything "boring" in their life. Inspiring tools for Net Generation students are in (Table 3).

#### Table 3.

Name of tool	Examples of freeware tools	Description	Link
Social Network	facebook	Facebook is an online social networking service	facebook.com
Blogs	moyblog	Service allows users to create blog, share the latest news, and chat with other on interesting topics.	moyblog.net
Rss	rss.i.ua	RSS technology allows to inform everyone about the new information published on website.	rss.i.ua
Wiki	Wikimapia	Wikimapia is an open- content collaborative mapping project that aims to mark and describe all geographical objects in the world.	wikimapia.org
Instant Messaging	skype	Skype is a voice-over- IP service	skype.com
File Sharing	Dropbox	Dropbox allows users to create a special folder on	dropbox.com

**Collaboration tools via e-learning. Examples 3** 

	each of their computers,	
	then Dropbox	
	synchronizes them in the	
	way that it appears to be	
	the same folder (with the	
	same content) regardless	
	of which computer is	
	used to view it	

Source: Own elaboration based on data gathered from related sites

The research shows that Net Generation students are strong visual learners and weak textual learners.

One study has examined a library class at California State University (Hayward), where students frequently ignored long text directions for homework assignments. When the assignments were rewritten with using images first, student scores increased from 11 to 16 percent, and refusal to complete the assignment lowered from 10 to 14 percent (Roos 2012).

#### Table 4.

Name of tool	Examples of freeware tools	Description	Link
Presentation	Zoho Show	Online document management software	www.zoho.com
Video	youtube	YouTube is a video- sharing website	www.youtube.com
Pictures	Picasa	Picasa is an image organizer and image viewer for organizing and editing digital photos, also an integrated photo- sharing website	picasa.google.com
Mind Mapping	bubbl.us	Mind Mapping is a program for creation colorful mind maps to print or share with others	bubbl.us

Collaboration tools via e-learning. Examples 4

Source: Own elaboration based on data gathered from related sites

Another Norm of the Net Generation is *entertainment*. Devices and technologies such as iPads, Tablets, e-books, video, webcast, podcast etc. can be particularly fascinating for students.

Educational entertainment (edutainment) is any entertainment content that is designed to educate as well as to entertain.

Examples of edutainment are:

- audio and video;
- streaming multimedia;
- 3D audio, video;
- film, television and radio;
- virtual museums;
- educational games;
- virtual worlds (3D visualized environment, 3D gaming interface integrated to form 3D).
- According to (Falloon 2010):
- virtual worlds give users the ability to carry out tasks that could be difficult for them;
- in the 'real world', there are constraints, including cost, scheduling or location;
- virtual worlds' persistence allows to continue and grow social interactions;
- which can serve as a basis for collaborative education;
- virtual worlds can adapt to meet user needs.

One of the main benefits of using virtual world in education is avatars.

Avatar is employed to read for the user the subject matter and to entertain the learner by jokes, gesture, facial expressions.

The example of educational virtual worlds and avatars is project vAcademia.

VAcademia is all that is necessary for effective e-learning: a comfortable auditorium, interactive whiteboards, text and voice communication, support for webcams, and 3d recording.

Avatars that represent their users appear in many facets of the cyber space such as virtual boardrooms, messaging and chatting, internet or console gaming, marketing, broadcasting, film, television, education and training (examples are provided on http://vacademia.com).

Another advantage of the system is the ability to integrate with Learning Management System (LMS). This will give the opportunity to use the already-tested ways of learning together with innovative ones.

Another Norm of the Net Generation is Scrutiny, or Transparency.

This rule is very important especially for e-learning, because the students are critics and skeptics. Nowadays students must know that Our Facebook and Google accounts could be seen by anyone and our posts are permanent. The Last Norm of the Net Generation is *integrity* or *honesty*. As we notice above, we must remember that working together is not cheating in world of Net Generation. This norm usually used in collaborative learning.

### **3. ACTIVE E-LEARNING**

When we talk about Net Generation's learning style, we have to highlight their high activity in education process. Apparently, they do not want to be passive observers, and aim to be active participants, of course, only in case of the obvious benefits of this experience for yourself.

E-learning tools offer at least two powerful benefits for education. First, as you see above, collaboration is a part of the fabric of Web tools. Second, e-learning tools allow students to become active creators of content rather than passive consumers of information.

This second benefit moves teachers from a role of knowledge transmitter to a position of a mentor. We talk about this discussing the first rule of Net Generation (freedom).

Nevertheless, we cannot exclude completely passive learning and provide only active learning.



Figure 3. Passive e-learning Source: Own elaboration

Both types of engagement should have their places in the e-learning-teaching process.

Active learning can exist only on the basis of passive learning, when we get information but we do nothing with it (Kuhlmann 2007).

So, at first we have the following structure (Figure 3).

In this structure, student receives necessary knowledge base for future use.

As stated in (Kuhlmann 2007), ...we read books and newspapers. We watch TV. No one would suggest that these are ineffective means of learning. Keep in mind, passive does not mean ineffective. It also does not mean that you have to stick with bullet points or just text as in the example above. The learner does not have to do anything with the information at that point in the course, but this does not mean that you cannot add variety in how it may be delivered".

Further, having a basic knowledge, we use the following structure (Figure 4).



**Figure 3. Active e-learning** Source: Own elaboration

In this structure, active learning is consistent of:

- exploring;
- creating;
- experience;
- connecting;
- reflecting;
- sharing.

Nevertheless, it is important to use combination of different learning styles; this can foster development of active learning experience.

Mix up different learning styles and methods:

- informal, incidental learning;
- integration of technology and media in learning (webinars, social networking sites, Avatars);
- case study;
- problem situation;
- ice breakers (ask a provocative question to break the ice);
- project-based;
- programmed instruction;
- context learning;
- the research method of teaching;
- modular training etc.

#### CONCLUSION

So Net Generation requires new approaches to adapting their learning styles. According to the main characteristics of this generation, e-learning may fully satisfy them. On the one hand, we need to understand that new tools open up new perspectives; on the other hand, traditional learning is always in demand. Only a harmonious mix of classic learning and new approaches can meet the needs of Net Generation.

#### REFERENSES

Create Engaging E-Learning Courses You Can Be Proud of By Tom Kuhlmann, available at http://www.articulate.com/rapid-elearning/create-engaging-elearning-courses-you-can-be-proud-of, (accessed on 16 August 2013)

- Digital Natives, Digital Immigrants By Marc Prensky, available at http://www.nnstoy.org/download/technology/Digital%20Natives%20-%20Digital%20Immigrants.pdf, (accessed on 16 August 2013)
- *Generations X,Y,Z and the Others*, available at http://www.iamovers.org/ new%20images/portal%20pdfs/2008\_03\_04.pdf, (accessed on 19 August 2013)
- *How Net Generation Students Work*, available at http://people.howstuffworks.com/how-net-generation-students-work1.htm, (accessed on 16 August 2013)
- Influence of generations' traits on teaching and learning in an open distant learning (ODL) environment, available at http://uir.unisa.ac.za/bitstream/handle/ 10500/8756/sithole\_k\_ODL\_067\_2012.pdf?sequence=1 (accessed on 16 August 2013)
- Oblinger, D. G., Oblinger, J. L., eds., 2005: *Educating the Net Generation*. EDUCAUSE, Washington, D.C., 2005, 264p. ISBN 0-9672853-2-1.
- Tapscott, Don, 2009: Grown up digital: how the net generation is changing your world.Mc Graw Hill, New York, 2009, 368 p., ISBN: 978-0-07-150863-6
- *Teaching and learning with the Net Generation*, available at http://csdtechpd.org/pluginfile.php/1622/mod\_glossary/attachment/25/Teaching \_and\_Learning\_with\_the\_Net\_Generation.pdf, (accessed on 16 August 2013)
- Use Their Tools! Speak Their language! By Marc Prensky, available at http://www.marcprensky.com/writing/Prensky-Use\_Their\_Tools\_Speak\_ Their\_Language.pdf, (accessed on 16 August 2013)
- Using avatars and virtual environments in learning: What do they have to offer?, available at http://web2integration.pbworks.com/f/Using%2Bavatars%2 Band%2Bvirtual%2Benvironments%2Bin%2Blearning.pdf, (accessed on 16 August 2013)

# **E-LEARNING & LIFELONG LEARNING**

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Abstract: Digital literacy and other key competences are an essential condition of the preparation of specialists in the knowledge society, and employability of workforce and of all citizens. In this context, not only formal education but also non-formal and informal education will be of crucial importance for lifelong learning. E-learning is one of the main, modern forms, methods, technologies of teaching and learning today. In the present article the author considers the relation between e-learning and lifelong learning: the challenge and prospects for the future; comparative characterisation of Formal, Non-formal and Informal (Distance) Learning; new proposals of Postgraduate studies and specialization in the context of the New Digital Agenda for Europe 2013-2014 and some research outcomes – results of a student survey in the area of e-learning.

**Keywords:** E-learning, lifelong learning, formal, non-formal, informal learning, education.

#### **INTRODUCTION**

In Saint Petersburg G20 Leaders' Declaration of September 6, 2013 we can read: "26. Policy reforms to support higher employment and facilitate job creation and better matching of skills with job opportunities are central in our growth strategies. We commit to take a broad-ranged action, tailored to national circumstances, to promote more and better jobs:..". and later: "Invest in our people's skills, quality education and **lifelong learning programs** to give them skill portability and better prospects, to facilitate mobility and enhance employability. (G20 Leaders' Declaration, September 6, 2013, St Petersburg" (http://www.g20.utoronto.ca /2013/2013-0906-declaration.html). The 'Europe 2020' strategy for smart, sustainable and inclusive growth calls for the development of knowledge, skills and competences for achieving economic growth and employment. The accompanying flagship initiatives 'Youth on the Move' and the 'Agenda for new skills and jobs' emphasise the need for more flexible learning pathways that can improve entry into and progression in the labour market, facilitate transitions between the phases of

work and learning and promote the validation of non-formal and informal learning (Council Recommendation, 2012). In this context, later on in the paper, the author argues that not only formal education but also non-formal and informal education, based on e-learning, will be of crucial importance for lifelong learning.

#### 1. LIFELONG LEARNING IN KNOWLEDGE SOCIETY: THE CHALLENGE AND PROSPECTS FOR THE FUTURE

In the course of the last 20 years we have witnessed great economic changes, economic, social, political, and technological developments in Poland as well as in all European countries and around the world that require adequate systems, accompanied by fast and permanent measures to effectively adapt to new challenges. At the international level and national levels a number of documents have been written to address these issues: *White Paper on Education and Training Teaching and Learning Towards the Learning Society European Commission COM(95) 590, November 1995; - eEurope 2002; - The White Paper on Youth policies (2002); The Copenhagen Declaration (30 November 2002) and the Council Resolution (19 December 2002); The Digital Agenda for Europe 2013-2014 (2013); Strategy of Information Society Development in Poland for the years 2007-2013. Other documents have also been prepared that describe in detail all challenges for contemporary states, economies, society and citizens. Among the priorities is the lifelong learning (LL).* 

For example, in Lisbon, it was made clear that achieving full employment would require a radical transformation of the economy and skills to match the opportunities of the new economy.

The first challenge is education and training. Education will make a major contribution to developing new skills but its results will inevitably only be realised in the longer term. More needs to be done (*eEurope 2002*)

First of all this concerning jobs for information technology professionals. The Digital Agenda for Europe 2013-2014 (https://ec.europa.eu/digital-agenda/en/news/digital-do-list-new-digital-priorities-2013-2014) analyses and describes in particularly 5) Entrepreneurship and digital jobs and skills and in this documents has stressed, that "The Commission signals that by 2015 700,000 to 1 million ICT jobs will not be filled in Europe, due to lack of skilled personnel (The Digital Agenda for Europe 2013-2014).

However, the challenge is wider than just meeting the demand for information technology professionals. Digital literacy is an essential element of the adaptability of the workforce and the employability of all citizens. In this context, the responsibility of enterprises for training 'on the job' will be of crucial importance for *lifelong learning*. An award for enterprises that are particularly successful in developing human resources could be envisaged.

...Work can be made more attractive through more attractive and accessible through flexible work arrangements such as telework. Particular efforts should be made to attract women to the information technology professions where they are massively underrepresented and where they represent a largely untapped resource in most countries. (*eEurope 2002*)

In the chapter entitled "Working in the knowledge-based economy" the Lisbon European Council concluded that: - *Lifelong learning* should be given higher priority as a basic component of the European social model. - The need for a substantial increase in per capita investment in human resources. - A European framework should define new basic skills, with decentralized certification procedures, to be provided through *lifelong learning* and a European diploma for basic IT skills should be established. - The need for adaptability through flexible management of working time and...through making it easier to reconcile working and family life. (eEurope 2002)

In *White Paper* (1995) in the Chapter **C** *Action in the Member States* we can read: " Significant developments are taking place throughout Europe. All education systems are seeking to improve quality, to develop training provision, to provide lifelong learning, and to improve the use of financial resources." (White Paper, 1995)

Education, training and employability were recognised by the European Lisbon Council in March 2000 as an integral part of economic and social policies needed to attain the strategic goal of Europe becoming the world's most dynamic knowledge-based economy by 2010.

In follow-up to the report on the concrete future objectives of European education and training systems (March 2001), the detailed work programme adopted by the Council (14 June 2002), called for the development of ways to officially validate non-formal learning experiences. The Commission White Paper entitled 'A new impetus for European Youth' (21 November 2001) which set out a new framework for European co-operation on youth affairs, stressed the importance of non-formal learning and education.

The Council Resolution on Lifelong Learning (27 June 2002) invites the Member States to encourage co-operation and effective measures to validate learning outcomes. The European social partners' 'Framework of actions for the lifelong development of competences and qualifications' (14 March 2002) underlines the point that the recognition and validation of competences and qualifications is both a shared objective and a main priority for action at the European level.

The Copenhagen Declaration (30 November 2002) and the Council Resolution (19 December 2002) on the promotion of enhanced European co-operation in vocational education and training acknowledged that priority should be given to developing a set of common principles regarding validation of non-formal and informal learning with the aim of ensuring greater comparability between approaches in different countries and at different levels.

The Council and Commission Joint Interim Report (26 February 2004) to the Spring European Council, 'Education and Training 2010', states that the development of common European references and principles can usefully support national policies. Although such common principles do not create obligations for Member States, they contribute to developing mutual trust between the key players and encouraging reform. The Joint Interim Report specifically calls for the development of common European principles for **the validation of non-formal and informal learning**. (*Draft Conclusions ...*, Council of the European Union, Brussels, 18 May 2004)

The concept of lifelong learning is already a reality today and in the future its importance will continue to grow! The term "lifelong learning" means a new approach to learning, and suggests the possibility of lifelong learning in a variety of formal and informal situations.

The concept of lifelong learning was disseminated in the 60's, 70's, and has since greatly expanded its scope. The concept of lifelong learning and education is based on a formal education system under which a person is provided with an opportunity to raise their educational level. This system is mainly focused on offer.

The concept of lifelong learning is focused on the person in the context of his employment and active citizenship. In this sense, lifelong learning is focused on requirements posed by the labour market, rather than on a proposal from the vocational education and training.

Lifelong education involves training, carried out both inside and outside of the formal education system in a wide variety of new contexts. This means that the main key skill is the ability of a person to search for new knowledge and develop new competencies without the support of formal education.

Further development of the concept of lifelong learning calls for new ways of thinking in the education system. These include:

- A structured approach to learning, in which students are actively involved in learning from pre-school and primary school level;

- Providing access to information on formal and informal education;

- Availability of verification systems for competence acquired outside the formal education system. (*Report: Lifelong learning ..., 2002*).

The number of "digital natives" is growing and they are in need of continuing education and lifelong learning. If current trends in Europe continue, characterized by an aging population over the next two decades, more than 50 % of the population will be older than 50 by 2030, and life expectancy will be increased to 90 years. Children of the 21st century - modern "digital natives" born in the world of information technology, like their parents, will have to undergo lifelong training in the use of the new technological environment. To meet the educational needs of the population, lifelong learning and continuing education system must be transformed.

Also, such an educational activity will require the person to make financial and physical efforts and investments. (*Il'chenko, 2010*)

### 2. E-LEARNING AND LIFELONG LEARNING. FORMAL, NON-FORMAL AND INFORMAL LEARNING IN LIFELONG LEARNING CONTEXT

The Council conclusions of 12 May 2009 on a strategic framework for European cooperation in education and training (ET 2020) (1) state that lifelong learning should be regarded as a fundamental principle underpinning the entire framework, which is designed to cover learning in all contexts whether **formal, non-formal or informal.** (COUNCIL RECOMMENDATION, 2012)

The validation of learning outcomes, namely knowledge, skills and competences acquired through non-formal and informal learning can play an important role in enhancing employability and mobility, as well as increasing motivation for lifelong learning, particularly in the case of the socio-economically disadvantaged or the low-qualified. (COUNCIL RECOMMENDATION, 2012)

European countries are increasingly emphasising the need to recognise the full range of an individual's knowledge, skills and competences – those acquired not only at school, university or other education and training institutions, but also outside the formal system. (*Web-site of European Commission concerning Education & training and Lifelong Learning Policy*)

This requires new approaches to validate such learning experiences (i.e. identify, document, assess and/or certify), making them usable for further studies or advancement in work. Helping people in this way could also make a contribution to smart, sustainable and inclusive growth. (*Web-site of European Commission concerning Education & training and Lifelong Learning Policy*)

*Formal learning* means learning which takes place in an organised and structured environment, specifically dedicated to learning, and typically leads to the award of a qualification, usually in the form of a certificate or a diploma; it includes systems of general education, initial vocational training and higher education (COUNCIL RECOMMENDATION, 2012)

There are different definitions of *formal*, *non-formal* and *informal* learning, developed by scientists and authors. Some well known definitions of this category can be found in Wikipedia (http://en.wikipedia.org/wiki/ Nonformal\_learning) and on the Web-site of European Commission (http://ec.europa.eu/education/lifelong-learning-policy/informal\_en.htm)

Learning taking place outside formal education and training bodies is crucially important for individuals, companies and society at large. Existing information about validation of non-formal and informal learning is, however, in most countries, rather limited in scope. Making informal and non-formal learning visible and validated is an intrinsically challenging task. (European Inventory — Validation of non-formal and informal learning. 2004. URL: http://www.ecotec.com /europeaninventory). The European inventory is an ongoing project. Three complementary reports have so far been produced: one by Danielle Collardyn and Jens Bjornavold and two by ECOTEC Research & Consulting. All three reports are available on Web site of European inventory Project (http://www.ecotec.com /europeaninventory)

Educational institutions together ... (educational institutions, author comments) create pressures on models of educational provision at all stages of education from childhood to workplace learning. Heppell (2007), amongst many, points to the need for an education system that helps people to help each other, rather than one that delivers learning. The barriers between formal and informal learning, and between online and face-to-face learning are currently being broken down, allowing the development of new models that take into account the range of learners' experience outside formal study, and the affective elements of learning. (Buckingham, Ferguson 2012). Social learning has been conceptualised as societal learning in general, as processes of interaction that lead to concerted action for change, as group learning, and as the learning of individuals within a social context (Blackmore 2010). The author's conception of online social learning (Buckingham, Ferguson 2012) takes into account the changing affordances of a world in which social activity increasingly takes place at a distance and in mediated forms. It is succinctly expressed by Seely Brown and Adler (2008) as being "based on the premise that our understanding of content is socially constructed through conversations about that content and through grounded interactions, especially with others, around problems or actions," (Buckingham, Ferguson 2012). The characteristics of online social learning have been described by Buckingham, Ferguson in their publication in 2012 (Buckingham, Ferguson 2012: 9).

#### Table 1.

Features	Formal (D)L	Non-formal (D)L	Informal (D)L				
Where?	In public (state-run) and private institutions (high school, university)	Basically out of state and private institutions, sometimes with their support or involvement	Outside of public and private educational institutions. In everyday life				
A clear educational purpose	Yes	Most often Yes	Sometimes it is not explicitly present or None				
Organization of the process	It is clearly defined, there is a time frame,	Often it is clearly defined, there is a	Spontaneous, on demand, there is no				

# Comparative characterisation of formal, non-formal and informal (distance) learning

	the programtime frame, the(scheduler) isprogram (scheduler)preparedis prepared		clear time frame, learning, within a network, based on own and other people's experience
Accreditation achieve- ments, formal confirmation	The official document – a state certificate, diploma	Most often a non- state certificate, a confirmation, other documents or without certification	Without certification
Teacher (Lecturer)	Academic staff, lecturer, academic teacher of educational institution, etc.	Coach, tutor, lecturer	Colleagues in the network; often, if learners have interaction with a specific content, teacher or co-worker, colleague does not need to present
IT Tools,	LCMS, CMS,	LCMS, CMS,	Generally, social
place	DL platform, educational portal, etc.	DL platform, educational portal, social networking sites	networking sites which are a learning environment, often personal learning environment for users and learners
Methodology	Constructivism, Conectivism, Student-centred paradigm, Programming teaching theory, Behavioristic theory, Cognitive pedagogy and psychology	Connectivism, Sometimes: Constructivism, Student-centered paradigm Programming teaching theory, Behaviouristic theory, cognitive pedagogy and psychology	Connectivism, Sometimes other pedagogy theory and methods
Lecturer- Student Commu- nication	Yes	Most often Yes	Sometimes it is not explicitly present or No. Nonformal Communication with colleagues, family, other persons

Time, Duration of education, learning?	Time of distance learning is limited. Formal distance education usually equal to the length of study or courses	Time of distance learning is limited. Distance education usually equals to the length or courses or didactic materials (video, post-cast, web-cast, etc.), other Open Educational Resources ( <i>OERs</i> )	Permanently, without time limits divided into short or long time periods
Examples	Distance courses in high schools within the traditional educational process (Bachelor, Master, skills training, improvement and increase of qualifications, postgraduate studies)	Distance training and learning courses of various organizations. The massive open online courses cMOOC, xMOOC Coursera, eDX, Udacity; Khan Academy TEDx Project. Open learning courses prepared by individual teachers and online communities	Independent decision "personal problems and tasks" with the help of the Internet. Visiting the virtual galleries and museums. Communication network with colleagues and friends. Participation in virtual communities of practice ("social learning")

Source: Own work based on (Bugaychuk 2013)

# **2.2. Different Initiatives in the Use of E-learning for Lifelong Learning at the University of Silesia**

The University of Silesia in Katowice (US) was established in 1968 and now, with 12 faculties and several interdisciplinary schools and centres, over 35 000 students, educated at Bachelor, Master and Doctoral levels and over 2000 academic staff is one of the largest in Poland. The university, within the framework of its own activity in the of area study, research, science, innovation, cooperation, national and international projects has launched various initiatives in the use of E-learning for lifelong learning. These initiatives include:

- Distance Learning Centre of the University of Silesia (US). The aims, concept as well as the methodology of e-learning implementation at the University of Silesia as well as the activity of Distance Learning Centre of US is described in depth in the article (Widła, Mrocheń, Półtorak 2009). The University of Silesia Distance Learning Centre provides technical support, course administration and training for teaching staff and students. Most recent data regarding the results of activity of the

Distance Learning Centre (DLC) are as follows: The University of Silesia e-learning platforms, supported by DLC, offer students more than 8000 hours of effective work on the 12 faculty platforms as well as other specific e-learning platforms. (Promotion Video, prepared by DLC for DLCC2013, 2013).

- Project "UNIVERSITY AS A PARTNER OF THE KNOWLEDGE ECONOMY" UPGOW (Smyrnova-Trybulska et al. 2009, 2010). The general goal of the project is the spreading of education within society at every stage of learning as well as increasing the quality of educational services and their stronger linking to the requirements of the modern economy. The project includes more than 40 reviewed open e-courses on various topics in different fields of study.

- University Television (TV-UŚ, http://telewizja.us.edu.pl/). TV UŚ broadcasts and publishes a range of materials covering University news and events, provides promotion and information, current issues and campaigns. TV UŚ and DLC UŚ also run online broadcasts (Promotion Video, prepared by DLC for DLCC2013, 2013);

- Internationalization of research and education is one of the priority directions of development of the University which collaborates with over 300 higher education institutions from all over the world and actively participates in EU-funded projects within the Lifelong Learning Programme (Erasmus - the most successful student and staff exchange programme in the world) and Framework Programmes (as partner and co-ordinator), for example PEOPLE MARIE CURIE ACTIONS International Research Staff Exchange Scheme (IRSES, IRNet Project);

- Broad offering of postgraduate studies (http://kandydat.us.edu.pl/us-boxes/11)

Other important initiatives in the area of using e-learning at the US for developing of innovations for education, science, research, infrastructure, lifelong learning include:

- Decree No. 66/2012 of 3 July 2012 by Rector of the University of Silesia on the principles of teaching classes at the university with methods and techniques of distance education. (http://bip.us.edu.pl/zarzadzenie-nr-662012). In particular, this document, formally allows one to teach up to 60% of classes in the remote mode.

- The Document "University of Silesia in Katowice — Development Strategy 2012-2020" (http://bip.us.edu.pl/sites/bip.us.edu.pl/files/strategia20130627 eng.pdf), in which such important aims are mentioned: 2.3.3.5. Increase in the number of elearning courses, and greater activity in distance teaching; 2.3.4.3. Organisation of lifelong learning courses and trainings – also in the form of e-learning in Polish and English – in the use of electronic databases for students, doctoral candidates and employees. Using and developing modern computer and information technologies for more individualised education in the form of e-learning and blended learning.

- Broad agreement on Digital Skills in Poland - Declaration CRASP (http://www.us.edu.pl/szerokie-porozumienie-na-rzecz-umiejetnosci-cyfrowych-w-polsce-deklaracja-krasp), and several important initiatives in area of developing

*Digital Skills* such as conferences, postgraduate studies, new specializations, projects at the *University of Silesia*.

# **2.3.** New proposals of Postgraduate studies and specializations in the context of New Digital Agenda

The postgraduate studies called "Multimedia Application and E-learning Teacher" will be developed on the basis of current postgraduate studies "E-learning in the teachers' profession" and on the basis of results of a new Project B2.2. entitled "Development of a set of national professional competence standards required by employers", which concerns the development of 300 standards of professional competence. This project is run by Doradca Consultants Sp. z o.o., Institute for Sustainable Technologies - National Research, IPiSS WYG International, ŁCDNiKP, and is particularly important and necessary. As part of the project, qualification standards will be developed for such contemporary innovative and necessary professions as "Multimedia Application Teacher", "Distance Learning Teacher", "On-line Examiner". The author of the article is involved in the project as a subject matter expert and in this paper will present concepts relating to the development of qualification standards for the new profession of Multimedia Application Teacher. Europe's future sustainable growth and competitiveness depends to a large extent on its ability to embrace the digital transformation in all its complexity. Information and communication technology (ICT) is increasingly impacting all segments of society and the economy. The Digital Agenda for Europe 2013-2014 (https://ec.europa.eu/digital-agenda/en/news/digital-do-list-new-digitalpriorities-2013-2014) analyses and describes in particularly 5) Entrepreneurship and digital jobs and skills and in this documents has stressed, that "The Commission signals that by 2015 700,000 to 1 million ICT jobs will not be filled in Europe, due to lack of skilled personnel. Additional action is needed to boost the overall number and the employability and mobility of ICT experts. Therefore the Commission will launch a 'Grand Coalition on Digital Skills and Jobs'."

That is why postgraduate studies called "Multimedia Application and E-Learning Teacher", described in this article, are particularly important and necessary in the context of global Digital Agenda for Europe 2013-2014 and in the context of successful decisions concerning teacher training and other specialists' training in the area of multimedia application, ICT and e-learning in Poland, and generally in the area of digital technology. A more detailed concept of Postgraduate studies was described in the author's other paper (Smyrnova-Trybulska 2013)

# **3. SOME RESEARCH OUTCOMES – RESULTS OF STUDENTS SURVEY IN THE AREA OF E-LEARNING**

One of first and the most actively functioning of distance learning platforms on US is the platform of Faculty of Ethnology and Sciences of Education in Cieszyn. The faculty e-learning platform contains a lot of interesting courses supporting learning.

Aims, functions and examples of distance learning platform for the Faculty of Ethnology and Sciences of Education in University of Silesia were more fully described in the previous articles of the author (Smyrnova-Trybulska 2009, 2010a), 2010b), 2012). Its key objectives are to:

- 1. Provide support for teaching programme courses, run in the full-time and part-time mode (hybrid learning),
- 2. Prepare future teachers to take advantage of distance learning to use elearning in own profession and to perform the role of a tutor,
- 3. Provide assistance with scientific research and pedagogical experiments carried out by department staff, graduate students as well as post-graduate students,
- 4. Foster international cooperation, in particular, through international projects;
- 5. Provide non-formal and informal distance education in ICT area, and other subjects area for future and current teachers, other.

In the context of the subject of this article, I would like to provide results of surveys conducted at the end of the second semester after the completion of 4 e-learning courses during this semester, within the framework of the subject of Information Technology by students of pedagogy (Figure 1-4). These courses were supported by full-time education which the prospective teachers attended during the realization of Information Technology subject (total 30 hours). 15 hours were taught in in physical presence form (conversational classes) and 15 hours in remote form (lectures).

The surveys were reflective in nature while the evaluation related to the students' opinions about the courses and their assessment in terms of substantive, methodological, technological, organizational aspects, and e-learning as technology, methods and forms of learning. The students expressed their preferences regarding the classes mode (traditional, presence, on-line via Internet, other) as well as the reasons for their individual choices. The survey questions were answered by 49 first degree full-time students . The survey was anonymous and was accessed in the close distance course on the Distance learning platform. This paper includes answers to several questions. In the author's next publication, all results and their analysis will be provided.

Here you can indicate whether you prefer classes:									
Answer	Medially	Total							
Via the Internet	51%	25							
Via the Internet with the assumption that it is carried by the same person	22%	11							
Traditional	20%	10							
Traditional, assuming that it is carried by the same person	6%	з							
Total	100%	49/49							

Figure 1. Survey outcomes: Students' preferences regarding mode of classes Source: Own work

One of the questions was: *What are the reasons for this choice?* Some variants of an answer. Option 1 "*Classes via the Internet*" was selected by 51% of students. Examples of response versions to justify the choice made are as follows:

- Possibility of work at home;
- *More time to answer relating to a specific module;*
- The reason is easier and quick access to information;
- Not normalized, unlimited learning time;
- The possibility of studying the material at any time;
- It facilitates and shortens the time to commute to the university;
- You can always refer to the module;
- Because you can do these activities at any time individually;
- Through the internet I can work in my spare time, whether during the day or at night. You can work from home;
- great convenience, comfort, the ability to perform the tasks at appropriate time for me, easy access to the materials;
- *due to 100 % availability at all times of the materials and testing;*
- There is no need to commute to classes at the university, you can spend as much time as you like and do it at any time;
- It is a great help;
- You can do it in your free time.

Next question concerned the reasons for selecting the option to answer: "Via the Internet with the assumption that it is taught by the same person". This Option was selected by 22% of students. Versions of responses to justify the choice made include:

- It is logical;
- Since it is possible to consult face-to-face and availability of didactic information at home;
- Internet makes it easy to work on exercises and lectures;
- Freedom of TIME, other.

Third option for selecting was: *"Traditional"*. Option 3 was selected by 20% of students. Examples of response versions to justify the choice made are as follows:

- I've grown used to this;
- If you have problems you can immediately seek explanations;
- The traditional form promotes regularity and accuracy;
- Other

Fourth option for selecting was: "Traditional, assuming that it is taught by the same person". Option 4 was selected by 6% of students. Examples of response versions to justify the choice made are as follows:

- I prefer traditional classes because I can then immediately consult the teacher about problems ... I have contact with her/him directly and she/he can help me solve problems ... ;
- The teacher can show me how to do a specific task, which I cannot do at home. In addition, traditional activities are more fair and you can just learn more during such classes;
- Because I prefer traditional classes than by the Internet.

Of course, the results of the survey will be analysed even further, but already at this moment you will find that over 73 % (almost three quarters) of the students prefer classes on-line and it motivates us to continue to actively implement this form of teaching, of course taking into account all of the students' requirements and their suggestions for improvement of this type of classes and educational activities.

Please rate on a scale of 0-10, the top 10 point assessment												
	Average ranking:											
	0	1	2	3	4	5	6	7	8	9	10	
The scenario of the classes:												7.9
The ability of access to learning materials:												9.0
Facilitation due to work on the network:									1			8.4
Difficulties caused by the operation of the network:												5.3
The possibility of personal consultation with lecturer:												8.0
The degree of satisfaction with participation in activities conducted via the Internet.								1				7.7

Figure 2. Students' evaluation of distance learning and results of their own participation in distance courses

Source: Own work

Answer	Average	Total
Search for course materials, advancing own knowledge.	25%	37
Participation in the e-learning course(s)	15%	22
<ul> <li>Contact with friends (email, social network, programme messager)</li> </ul>	25%	36
Entertainment (on-line games, free surfing, watching movies)	13%	19
• File Sharing (P2P)	3%	e
Develop your interests, passions.	17%	25
Other	<b>—</b> 1%	2

Figure 3. Students' opinion about the purposes for which they most often use the Internet

Source: Own work

Answer	Average	Total
<ul> <li>Search engines such as Google</li> </ul>	44%	40
• Wikipedia	27%	24
Bibliographic schedules		3
Links contained on other sites	6%	5
Proven reliable web-sites	<b>———</b> 18%	16
Other	<b>2</b> %	2

# Figure 4. Students' opinion about ways in which they most often look for interesting materials on the Internet

Source: Own work

### CONCLUSION

In this article I have described and presented an analysis of existing formal national and international documents in the area of lifelong learning and use of e-learning to prepare professionals to function in the knowledge society, their years of experience regardless of the number of still existing problems and challenges convince the users that it is difficult to find alternative education to distance education in today's rapidly growing knowledge-based society, which requires trained personnel, quick update of knowledge and skills as well as expansion and upgrade of their skills.

In this context we can stress that not only formal education but also non-formal and informal education will be of crucial importance for lifelong learning.

To sum up one should say that first of all international cooperation, joint projects, exchange of experience in Europe and the world in theoretical and practical aspects of distance learning make it possible to create an efficient, optimal strategy for the implementation of e-learning and continuous improvement and adaptation to one's needs.

One of the such projects, entitled "International research network for study and development of new tools and methods for advanced pedagogical science in the field of ICT instruments, e-learning and intercultural competences", will be delivered by ten partners from 10 universities (in particular, by the University of Silesia) and 9 countries (the project in the Seventh Framework Programme funding scheme Marie Curie International Research Staff Exchange Scheme) in 2014-2017.

#### REFERENCES

Broad agreement on Digital Skills in Poland - Declaration CRASP available at http://www.us.edu.pl/szerokie-porozumienie-na-rzecz-umiejetnosci-cyfrowych -w -polsce-deklaracja-krasp (accessed on 13 September 2013)

- Buckingham Shum, S., & Ferguson, R., 2012: Social Learning Analytics. Educational Technology & Society, 15 (3), 3–26.
- Bugaychuk K., 2013: Formal, non-formal and informal e-learning: the nature, value, perspective Proceedings of the twentieth anniversary conference of representatives of regional research and education networks RELARN-2013 (June 1-6, 2013, St. Petersburg). - St. Petersburg, 2013, pp. 114-121, available at http://www.relarn.ru/conf/index.html (accessed on 25 August 2013)
- Central Asia. Sub-regional report on the mid-term evaluation to achieve the goals of Education for All (EFA) available at http://www.unesco.kz/publications /ed/CA\_MDA\_Report\_ru.pdf (accessed on 25 August 2013)
- COUNCIL RECOMMENDATION of 20 December 2012 on the validation of nonformal and informal learning Official Journal of the European Union (2012/C 398/01)
- Declaration of the European Ministers of Vocational Education and Training, and the European Commission, convened in Copenhagen on 29 and 30 November 2002, on enhanced European cooperation in vocational education and training "The Copenhagen Declaration" available at http://ec.europa.eu/education /pdf/doc125\_en.pdf (accessed on 25 August 2013)
- Decree No. 66/2012 dated 2012-07-03 Rector of the University of Silesia in the principles of the Silesian University of classes with methods and techniques of distance education available at http://bip.us.edu.pl/zarzadzenie-nr-662012 (accessed on 10 September 2013)
- Documents "University of Silesia in Katowice Development Strategy 2012-2020 " available at http://bip.us.edu.pl/sites/bip.us.edu.pl/files/strategia20130627 eng.pdf (accessed on 14 September 2013)
- *eEurope* 2002 An Information Society For All Action Plan prepared by the Council and the European Commission for the Feira European Council, 19-20 June 2000, Brussels
- *E-learning for the workplace. Creating Canada's Lifelong Learners available,* Canada, 2001 at http://openedpractices.org/files/e-learning\_for\_the\_ workplace.pdf (accessed on 25 August 2013)
- *European Inventory Validation of non-formal and informal learning* available at http://www.uk.ecorys.com/europeaninventory/ (accessed on 25 August 2013)
- European Inventory on Validation of non-formal and informal learning A Final Report to DG Education & Culture of the European Commission Manuel Souto Otero, Andrew McCoshan and Kerstin Junge (eds.) 2005 available at http://www.uk.ecorys.com/europeaninventory/publications/inventory /european\_inventory\_2005\_final\_report.pdf (accessed on 25 August 2013)

- G20 Leaders' Declaration, September 6, 2013, St Petersburg, available at http://www.g20.utoronto.ca/2013/2013-0906-declaration.html (accessed on 9 September 2013)
- Il'chenko O., 2010: Trends in the development of European education in the 21st century In: Conference Proceedings, 27 Sentebre-1 October Nizhniy Novgorod
   Uglich, June 2010, pp. 277-279 available at http://www.relarn.ru/conf/conf2010/list\_tez.pdf (accessed on 25 August 2013)
- Report from the Education Council to the European Council "The concrete future objectives of education and training systems" 5980/01 JW/ms 1 DG J EN COUNCIL OF THE EUROPEAN UNION available at http://ec.europa.eu/education/policies/2010/doc/rep\_fut\_obj\_en.pdf (accessed on 25 August 2013)
- *Report: Lifelong learning Requirements and Challenges*, Report of a seminar with the participation of representatives of the CIS countries and Mongolia, 2002
- Smyrnova-Trybulska E., 2009: Use of the Distance Learning Platform of The Faculty of Ethnology and Sciences of Education in Cieszyn (University of Silesia) in teacher training, In: Theoretical and Practical Aspects of Distance Learning. Collection of Scholarly Papers. Scientific editor: Eugenia Smyrnova-Trybulska. University of Silesia in Katowice, Cieszyn, 2009, pp.198-210, ISBN: 978-83-925281-4-2
- Smyrnova-Trybulska E., 2010: On Experience in the Delivery of E-learning-Assisted Lifelong Learning In: M. Drlik, J. Kapusta, P. Svec, DIVAI 2010 – Distance Learning in Applied Informatics. Conference Proceedings. Constantine the Philosopher University in Nitra, Faculty of Natural Sciences, Department of Informatics, Editors Nitra, pp. 277-284, ISBN: 978-80-8094-691-3
- Smyrnova-Trybulska E., 2010: Use of Distance Learning in the Training of Professionals in the Knowledge Society In: Use of E-learning in the Training of Professionals in the Knowledge Society. Monograph. Scientific Editor: E.Smyrnova-Trybulska, University of Silesia, Cieszyn 2010, pp. 137-161, ISBN: 978-83-60071-30-4
- Smyrnova-Trybulska E., 2012: Information and Educational Environment of the Faculty of Ethnology and Sciences of Education on the Internet In: ICT for Competitiveness 2012, Silesian University in Opava, School of Bissness Administration in Karvina, 2012 pp. 236-243, ISBN: 978-80-7248-731-8
- Smyrnova-Trybulska E., 2013: About Conception of Postgraduate Studies "Multimedia Application and E-learning Teacher" In: Learning while we are connected, Volume 2: Practice Papers, Ed.: N. Reynolds, M. Webb, V. Dagiene, M.M.Sysło WCCE2013 10th IFIF World Conference on Computers in Education, Toruń, Poland, July 1-7, 2013, pp. 45-51, ISBN 978-83-231-3093-2

- Strategy of Information Society Development in Poland for the years 2007-2013 available at http://www.piit.org.pl/\_gAllery/18/66/ 1866/7436.pdf (accessed on 14 September 2013)
- The development of new approaches to validation of non-formal and informal learning. In the Communication on Lifelong Learning (November 2001) The EC (2001) Communication on Lifelong Learning: formal, non-formal and informal learning available at http://ec.europa.eu/education/policies/2010/doc /non-formal-and-informal-learning\_en.pdf (accessed on 25 August 2013)
- *The Digital Agenda for Europe 2013-2014* available at https://ec.europa.eu/digitalagenda/en/news/digital-do-list-new-digital-priorities-2013-2014 (accessed on 25 April 2013)
- The learning continuity: European inventory on validating non-formal and informal learning – National policies and practices in validating non-formal and informal learning Danielle Colardyn and Jens Bjornavold (ed.) available at http://www.uk.ecorys.com/europeaninventory/publications/inventory/ learning\_continuity\_eu\_inv\_en.pdf (accessed on 25 August 2013)
- *The White Paper on Youth policies* (2002) Commission of the European Communities Brussels, 21.11.2001 Com(2001) 681 Final European Commission White Paper a New Impetus For European Youth available at http://ec.europa.eu/youth/ documents/publications/whitepaper\_en.pdf (accessed on 25 August 2013)
- *Web-page about Non formal learning in the Wikipedia* available at http://en.wikipedia.org/wiki/Nonformal\_learning (accessed on 27 August 2013)
- Web-site of European Commission concerning Education & training and Lifelong Learning Policy available at http://ec.europa.eu/education/lifelong-learningpolicy/informal\_en.htm (accessed on 27 August 2013)
- White Paper on Education and Training Teaching and Learning Towards the Learning Society European Commission COM(95) 590, November 1995 available at http://ec.europa.eu/white-papers/ (accessed on 25 August 2013)

# II. THEORETICAL AND METHODICAL ANALYSIS OF DISTANCE LEARNING

## PERSONALISED EDUCATION THEORY

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Abstract: The article describes a new form of e-learning – adaptive e-learning. The theory of this form is based on a series of pedagogical-psychological rules which are aimed at technical possibilities of today's IT. The very basics of adaptive e-learning is comprised of the student's learning style and a group of algorithms which will assign the suitable study material to a student according to his/her learning style. This whole process is automatized and secured by a virtual teacher – control manager. Its functions will be described in detail in this article.

**Keyword**: individualization, adaptive teaching process, e-learning environment, adaptive study aids

### **INTRODUCTION**

The term personalisation covers the adaptation of solution of various problems, situations and environments ... to specific conditions and requirements of individuals. Areas in which we can come across personalisation are numerous: advertising, web pages, ZOOs, museums, education, etc. Personalisation usually comprises three basic parts – for whom, what and in which manner. Let us focus on the personalisation of education.

One of the modern forms of education is e-learning. It is used in the simplest forms (presentation of study materials in PDF files on web pages), but also by using modern informatics systems that manage the education and many follow-up activities of the teacher and student (Learning Management System – LMS). Both of these classic examples do not take into account the specifics of individual students, i.e. not taking their learning preferences into account – learning style, abilities, characteristics, knowledge, requirements.

If we consider the time-proven pedagogical-psychological theories of education and today's possibilities of information technologies, we can try to create an education process tailored to the preferences and requirements of an individual. Attempts to individualise education have occurred in the past. Most of them remained, due to technical limitations, in the theoretical realm; they have not been practically realised. Today, with suitable technical equipment and possibilities, the situation is more favourable. We will try to create conditions for individualised personalised education in the environment of electronic learning.

Improvement of education via adaptive e-learning education should be visible in two levels. The first level is the acceleration of knowledge gain. The second level is more natural way of studying for every student thanks to taking individual characteristics of students into account. Optimal adaptive procedure should respect differences between students based on identified learning style with consideration to the changing knowledge and skills of a student during course. Based on the identification of personal characteristics and attributes there will be a studying material handled in a form that matches a student as much as it can. Adaptive form of education is the recently often mentioned area, but not fully explored and practically unrealized yet.

#### 1. PEDAGOGICAL BASIS FOR ADAPTIVE EDUCATION

In connection with education of pupils, basic didactic principles that concern individual approach must be reflected. The principles are rooted in personality psychology. They presuppose that every student is an individual and should be approached as such. By looking at the definition closer, it can be deduced that faster learning students should be taken into account as well as the slower ones. However, how can one secure optimal education that takes into account personal and other characteristics of students? If we take education done by the real teacher, only their pedagogical mastery affect how well they are able to manage a group of different students. Individual education with just one student can be an alternative to group teaching or teaching in class. When assessing student's characteristics it is important to consider the optimal mediation of curriculum in order to provide as comprehensive knowledge and abilities as possible. This can be secured by personalised education that is adapted for a specific person – the student. Education adaptation can be characterised as a change in the way of teaching the same curriculum; always in a different way that is most suitable for the needs of specific students. This is hardly achievable in classic classroom education, but possible in computer aided and managed education.

The theory of adaptive e-learning (Kostolányová 2012) is based – besides the already mentioned principle of individually – on other theories of renowned pedagogues and psychologists – Komenský, Gagné, Bloom, Kolb, Tollinger, etc. (Tollingerová 1977, Gagné 1975). Terms such as training, education, teaching and learning appear in the works of great authors of various nationalities. The theory

of adaptive education follows up their terminology and expands it to suit today's conditions and possibilities of electronic education.

In our personalisation design, the most important aspect is to define the term learning style. It is this type of characteristics of an individual that will serve as the basis for the education adaptation and personalisation. The classification of learning styles is the focal point of work and research of many authors. They examined various characteristics of students that are connected with learning and used them to divide students into student types. For our purposes, a learning style is a set of student's characteristics that can be taken into account in e-learning and define the learning style of each individual.

The adaptive e-learning education theory is based on the principle of programmed teaching, adaptive hypermedial systems and principles of Gagné's event education. The adaptive education theory shares a basic principle with programmed teaching (Tollingerová 1977): Dividing curriculum into small units, a verification of these small units and a reaction of educational system to student's understanding of the curriculum. From the adaptive hypermedial systems (AHA) (Brusilovský 2001, 2005), whose essence is a reaction to user's behaviour and control of his movement in the system, the adaptive e-learning theory takes monitoring of the student (we further mention logging of education process) and feedback implementation. Gagné's theory gave origins to the structure of adaptive study material (see below) (Kostolányová 2012).

### 2. DESIGN OF ADAPTIVE EDUCATION MODEL

Taking into consideration the theoretical foundations of personalisation in general, the system of adaptive education is divided into three parts – area for which we prepare personalisation, area in which we create personalisation and mechanism that is used for its practical execution.

The theoretical model of adaptive e-learning can be seen in figure no. 1 (Kostolányová, Takács, Šarmanová, 2011a). The system comprises 3 parts – student module, author module and virtual teacher module.

The system has been divided into three parts from the practical point of view:

- student's learning characteristics diagnosis, current education and testing of students (student module),
- structuring educational supports, creating methods for the making of adaptive studying materials (author module),
- design of adaptive algorithms for the optimal formation of customized learning environment (virtual teacher module) and recording the education process

Each part deals with several sub-problems:

- In order to react to different learning characteristics of students, the controlling educational software must know student's information, the ones which influences the learning process. All of which are they?
- How to get information about student's learning characteristics?
- How should educational support material look like to be able to adapt to student's learning characteristics?
- How should the teacher (virtual) teach each type of student?
- These problems are solved within each module of the adaptive education system (Kostolányová 2013).



Figure 1. Adaptive education model diagram.

Source: Kostolányová, Šarmanová and Takács, 2012; Kostolányová, 2012

#### 2.1 Student module

After the completion of extensive background research and analysis of available publications on the issues of learning styles (Kostolányová 2010), characteristics that define the learning style of the student and that can be affected in the e-learning form of education (e.g. *sensory perception, social aspects, affective aspects, learning tactics, etc.*) have been selected. Values of these characteristics that define the learning style of the student are discovered by a custom tailored questionnaire.

#### 2.2 Author module

The author module is used for preparing, saving, and maintaining adaptive study materials. To divide the study aid we use the common way of dividing textbooks into chapters and subchapters. Considering the adaptability possibilities we further divided the curriculum into the so-called **frames** – they represent a fractional unit of information (in a typical textbook this would be one term). Furthermore, we know that teaching methods comprise the sequence of elementary learning steps – beginning of instruction, explanation, exercise, examination and finalisation. To be able to use this principle in the field of adaptable education, we separate the teaching process according to R. Gagné. We divide parts of frames into **layers**. There are three types of layers – instructional, testing and other. The instructional layer concerns the presentation of the curriculum – presentation, semantics, practising exercises, solved exercises, conclusion. Testing layers comprise exercises to be solved, questions and tests. Other layers include the motivational layer, the navigational layer and the layer with extending resources. These parts of the study aid are prepared for four sensory variants (verbal, visual, auditive and kinaesthetic) and in three depths of complexity of the curriculum (average, more comprehensive – slower instruction and more comprehensive – enriched with additional information and interesting facts).

#### 2.3 Virtual teacher module

Suitable form of the education process is understood as a suitably sequenced study material (as far as its parts are concerned). The managing programme that structures education and controls its comprehension is called the **virtual teacher**. This expert system covers several functions:

- Looks for the registered student's learning style (LS), i.e. characteristics that affect their learning. To this learning style it assigns personal education style (PES), i.e. the procedure that will suit the student the most (sequencing of individual parts of the study material in terms of the layer type and its sensory and depth variants).
- In a real, actual study material, some variants may not exist and some frames may not utilise all types of layers. Therefore the next step of the virtual teacher is to apply the personal education style of the student to the actual study material, i.e. to determine the **actual education style of the lecture**. The result of this is a specific sequence of layers and their depths.
- Based on the optimal AES plan of passing the lecture, the virtual teacher manages the education process, i.e. successively presents the frames and selected layers of certain depths and sensory variants to the student.
- Another issue that the virtual teacher needs to deal with is the reaction of the system to erroneous answers of the student. If the student answers to control questions and exercises correctly, they progress in accordance with the actual education style. However, if the student answers incorrectly, the situation must be solved in a suitable way, in the context of the given situation.
- The last function of the virtual teacher is to record the whole education process to allow for the analysis of all the situations and to gain feedback

concerning the correctness of student's characteristics, to verify the suitability of the study aids and to double check the correctness of the expert rules of the virtual teacher.

# 3. FORMAL STRUCTURE OF ADAPTIVE RULES AND ITS VERIFICATION

To determine the theoretically optimal personal education style for a specific student means to choose the most suitable sensory variant and add the optimal sequence of layer types and depths for each frame (complete in theory; with all types of layers). This variant and sequence of layers in it is used universally for each frame of the lecture.

Personal sensory variant of the student is defined by the most prolific type of their sensory perception, i.e. the form with the highest value out of verbal, visual, auditive or kinaesthetic perception. For other characteristics we form elementary rules of general format:

If the student has characteristics V1=a and V2=b,

then use layer sequence and depth X, Y, Z, ...)

where X, Y, Z ... individual layers (theoretic, semantic, ...)

V1, V2  $\dots$  characteristics of the learning style (motivation, self-regulation,  $\dots$ )

a, b, ... values of these characteristics..

Rules assigning the sequence and depth of layers when displaying the frame stem from the static and dynamic characteristics of the student. They are ruled by expert rules created by an expert – pedagogue and expert on adaptive education. There are many of these "elementary" rules – for each value of each characteristic, or even some of their combinations.

Let us contemplate the content of the mentioned rules. We already stated that they are expert pedagogical-psychological rules on how to teach a specific student with the defined learning characteristics. The content of these rules is the most demanding professional part of the whole theory of adaptive education. It cannot be expected that these rules will be ideally defined from the very beginning. They will have to be fine-tuned – on the basis of further research activities.

The first step to testing the designed rules is to verify their correct function by modelling the education process. To fully fine-tune the first three functions of the virtual teacher (creating the model, followed by simulating the recommended way of teaching) we need to define all basic types of virtual students and all variants and layers of the teaching aid.

We assign the virtual students with learning characteristics. By combining their values (working with 2–4 values for each characteristic) we arrive at 2,000 possible types of students. We simulate the education for these individual types or groups with one or more identical values. We model the virtual teaching aid using only their metadata.

After finishing the research and analysis of modelling tools (Balogh, Z., 2011; 2012) we decided to create our own modelling tool that would best suit our needs. The tool uses the already mentioned expert rules and algorithms to determine the personal education style and actual education style. It can visualise passing through the study material for different types of students and thus enable the inspection of their education styles. It also provides data for the analysis of the frequency of the passing through individual parts of the study aid. Special method of visualisation of the results of PES and AES displays a pattern of all theoretical variants of one frame (sensory perception and depth of instruction) with all possible layers. Into this pattern it can draw the progress recommended by the virtual teacher in the form of polygonal chain that connects individual layers in the recommended sequence and depth (Figure 2). We call this diagram a trace of adaptive education style for one type of student.

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Figure 2. Trace of Adaptive Education Process

Source: Kostolányová, 2013

### 4. MODELLING THE PROCESS OF ADAPTIVE EDUCATION

For pilot modelling of the education process we test elementary rules at first; for this reason individual characteristics are added to modelling gradually, not all at once. Selected characteristics were motivation, learning concept, depth of study, self-regulation and success rate. Values of individual characteristics are usually set to three values – minimum, average and maximum (0, 50, 100 or -100, 0, 100).

To model the functionality and correctness of all elementary rules we use a complete study aid (represented by metadata) with no variants or layers missing.

Procedure of modelling individual elementary rules:

- Simulation of teaching a student "average" in all characteristics (their PES should correspond with the "classic" way of teaching used in most textbooks);
- Simulation of teaching with the change of the tested characteristic to high and low; verification of the functionality and correctness of designed expert rules. This approach is first tested with one student and then with a group of students having the given value of examined characteristic and other characteristics being average;
- If the resulting diagram does not correspond with the expert's notion of PES, an error is noted down (incorrectly formulated expert rule or incorrect function of the PEStyl algorithm).

Using the same modelling tool, it is verified if the rules are correctly designed for the case when it is necessary to combine several rules that correspond with different student characteristics. At first combinations of two, then three and finally four characteristics were tested in all possible variants. E.g. for two characteristics – motivation and self-regulation – these combinations were tested: average values of motivation and self-regulation; low motivation and high self-regulation; high motivation and low self-regulation, etc.

In the second phase of modelling, functionality and correctness of the AEStyl algorithm were tested. In real-life education VT does not have an ideal study aid, which would always have all layers in every variant of instruction. For this reason we focused on the use of suitable substitute variants and layers of the study material, for situations in which the theoretically complete study aid is not available.

In the AEStyl determining algorithm it was necessary to map the situation of existing variants and layers and solve the situation in case of absence of some of them: substitute the missing layer with a "closest related" one, if such exists, or omit it altogether if it is not available in any other version.

In the pattern, the missing parts will be marked only by a small black dot; existing layers of corresponding variants are coloured (see for example Figure 3).

The experiments verified many correctly realised substitutions or leave-outs except for the following:

- when substituting a missing layer both were displayed; the original was incorrectly duplicated instead of replaced;
- in case of missing preferred sensory variant this was substituted by any other sensory variant instead of the second most preferred variant.

During the simulation of the education process some mistakes have been discovered (see more in Kostolányová 2013) and corrected.

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Figure 3. Progression through Incomplete Study Aid

Source: Kostolányová, 2013

### CONCLUSION

Today, e-learning in its classic form is almost obsolete. Personalisation, individualisation and student's tailored education has gained prominence and piqued the interest of numerous experts. The theory of personalised education as mentioned above is the basis for its gradual practical realisation.

Based on the analysis, the created adaptive LMS Barborka was implemented and tested. In the new theory – on the basis of practical testing in real education – there will be modifications concerning both student's characteristics and the managing rules of the virtual teacher. The collective authors of this idea believe that their efforts and endeavours will be rewarded in future in the form of modern, optimal and interesting way of learning.

#### REFERENCES

- Allen, D., W., 2003: 'The Effects of Technology on Education Theory and Practice: A 20-Year Perspective', Technology in Education: A Twenty-Year Retrospective. vol. 20, no. 1-2, pp. 49-57.
- Bain, L., and Xie, Y., 2010: 'Research on the Adaptive Strategy of Adaptive Learning System', In: Entertainment for Education – Digital Techniques and Systems, vol. 6249, pp. 203–214.
- Balogh, Z., et, al., 2012: 'Creating model educational processes using Petri nets implemented in the LMS', Proceeding of the 9<sup>th</sup> International Conference on Efficiency and Responsibility in Education 2012 (ERIE 2012), Prague, pp. 7-16.
- Balogh, Z., et, al., 2011: 'Interactivity elements implementation analysis in ecourses of professional informatics subjects', Proceeding of the 8<sup>th</sup> International Conference on Efficiency and Responsibility in Education 2011 (ERIE 2011), Prague, pp. 5-14.
- Brusilovsky, P., 2001: Adaptive hypermedia. In User Modeling and User Adapted Interaction. Volume: 11, Issue: 1-2, Publisher: Springer, Pages: 87-129, ISSN: 0924-1868
- Brusilovsky, P., et, al., 2005: Interactive Authoring Support for Adaptive Educational Systems. Proceeding of the conference on Artificial Intelligence in Education: Supporting Learning through Intelligent and Socially Informed Technology. IOS Press Amsterdam, The Netherlands. ISBN: 1-58603-530-4
- Gagné, R., M., 1975: Podmínky učení. Praha: SPN. pp. 287.
- Komenský, J., A., 1947: Analytická didaktika. Praha, SPN.
- Komenský, J., A., 1948: Didaktika velká. Brno, Komenium.
- Chih-Ming, C., Hahn-Ming, L., and Ya-Hui, C., 2005: 'Personalized elearning system using Item Response Theory', Computers & Education, vol. 44, pp. 237-255.
- De Bra, P., et, al., 2003: 'Aha! the Adaptive Hypermedia Architecture', *Proceedings of the ACM Conference on Hypertext*. vol. 14, pp. 81-84.
- Hsiao, I-H., et, al., 2010: 'Guiding students to the right questions: adaptive navigation support in an E-Learning system for Java programming', Journal of Computer Assisted Learning, vol. 26, no. 4, pp. 270-283.
- Hsiao, I-H., et, al., 2011: 'Open Social Student Modeling: Visualizing Student Models with Parallel Introspective Views', Lecture Notes in Computer Science, vol. 6787, pp. 171-182.
- Kostolányová, K., 2012: *Teorie adaptivního e-learningu*, Ostrava: Ostravská univerzita.
- Kostolányová, K., 2013: Adaptive Education Process Simulation in Electronic Environment. In: Distance Learning, Simulation and Communication 2013. Proceedings (Selected papers). Brno: University of Defence, 2013, p. 106-112. ISBN 978-80-7231-919-0.
- Kostolányová, K., Šarmanová, J., and Takács, O., 2011a: 'Structure of study supports for adaptable instruction', The New Educational Review, vol. 2011, no. 25, pp. 235-247.
- Kostolányová, K., Šarmanová, J., and Takács, O., 2011b: '*Classification* of Learning Styles for Adaptive Education', The New Educational Review, vol. 2011, no. 23, pp. 199-212.
- Kostolányová, K., Šarmanová, J., and Takács, O., 2011c: '*Experimental* Verification of Learning Styles in e-Learning', Proceeding of the 8<sup>th</sup> International Conference on Efficiency and Responsibility in Education 2011 (ERIE 2011), Prague, pp. 261-270.
- Kostolányová, K., Šarmanová, J., and Takács, O., 2012: Adaptive elearning and its evaluation. Journal on Efficiency and Responsibility in Education and Science, vol. 5, pp. 212-225, ISSN: 1803-1617
- Kostolányová, K., 2012: *E-learning form of adaptive instruction* In: Proceedings DIVAI 2012 - 9th International Scientific Conference on Distance Learning in. Nitra: Faculty of Natural Sciences, Constantine the Philosopher University in Nitra. pp. 194-201, ISBN: 978-80-558-0092-9
- Turčáni, M., and Magdin, M., 2012: The Impact of Interactivity on Students'Results When Passing Through an E-learning Course. In: DIVAI 2012. 9th International Scientific Conference on Distance Learning in Applied Informatics. Nitra: UKF, ISBN: 978-80-558-0092-9

## AN ATTEMPT TO APPLY THE SERVQUAL METHOD TO EVALUATE THE QUALITY OF AN E-COURSE

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Abstract: The challenge faced by e-learning is to ensure its quality. In addition to traditional methods of quality assurance, there is an increasing tendency to use tools and techniques from other disciplines. The paper presents the possibility of application of the SERVQUAL method in assessing the quality of an e-course. The method and the main stages of the examination have been characterized. A survey was used to assess the expected and the perceived quality of an e-course. Exemplary results have been presented. The Servqual method allows to identify the discrepancies that may arise between the expectations of the student and his perception of the e-course. The methodology can allow to make improvements to the e-course.

Keywords: E-learning, e-course, quality, SERVQUAL

#### **INTRODUCTION**

E-learning is the transfer of knowledge conducted with the use of the computer tools and multimedia. The level of use of information technologies in e-education varies significantly. There are e-courses that only support traditional teaching processes, and those which in whole or in part replace them. The implementation of e-learning, however, is a complex undertaking. It requires effective quality management at the university level. It also calls for continuous improvement of the quality of e-courses in which the student takes part.

The student, recipient of an e-course, has its own requirements and will expect a course of appropriate quality. Quality complying with his needs, which are shaped, among others, by the development of information technologies and a widespread use of the Internet.

There are different methods of assessing the service quality, but the SERVQUAL method is becoming more and more popular. The growing interest in the method

results from its advantages such as: the simplicity to apply the method, the possibility to select different evaluation criteria, the possibility to monitor the quality of services at the time, and the possibility to benchmark.

Although the SERVQUAL method is universal, it should always be adapted to the conditions in which the service is performed. The paper presents an attempt to apply the SERVQUAL method to assess the quality of an e-course.

## **1. QUALITY OF AN E-COURSE**

Distance learning or e-learning is no longer a set of electronic presentations made available for students nor is it providing a pdf file or a link to a website. Nowadays, e-learning/e-teaching or e-education means an interactive method of education which comprises delivering teaching materials, managing the didactic process, monitoring and assessing progress, and ensuring student-teacher as well as student-student communication and interaction by means of information technologies, particularly Internet communication tools (Walasek et al. 2011). Distance learning is becoming a new way of gaining knowledge, alternative to traditional education and the existing educational structures.

Looking at e-learning as a service and following the terminology of quality management, it can be assumed that the quality of e-education can be measured by the extent to which a service (e-education) caters for the demands and expectations of the client. The main recipient of e-education is the student for whom an e-course is a 'product' on offer. The student is the external client of e-education. The academic teacher who develops an e-course and conducts online classes is the internal client.

With such a division of the stakeholders, there seems to be an obvious need for the evaluation made from the point of the external client– the student, the internal client – the e-teacher as well as for the peer evaluation or peer review of the e-course. The surveys or evaluation sheets are very often based on the e-course assessment criteria. Attempts to develop such standards were undertaken by the Association for Academic E-learning (Zając and Stanisławska 2009). The assessment criteria for the quality of e-classes are publicly available at the Association's web page (http://www.sea.edu.pl/kryteria/).

More and more courses that are created for universities and colleges tend to be of very high quality. They meet all or nearly all the assessment criteria, they are subject to regular evaluation with input from the students, teachers and managers. There is a significant change in the methodology of e-courses as far as the application of communication tools, multimedia, visual setting, etc. is concerned. Often, however, these are uncoordinated actions and the methods used to improve the e-learning quality do not always go in the right direction. Reflecting on the further improvement of the e-course and trying to understand the needs of internal and external clients, the present authors tried to use the SERVQUAL method to assess the quality of an ecourse.

## 3. METODA SERVQUAL

Together with the growth of interest in e-learning, more attention will be paid to the tools enabling the evaluation of e-education quality. One of the methods measuring service quality in a number of areas is the SERVQUAL Method (SERVices QUALity), which was developed in the 1980's by Parasuraman and co-authors (Parasuraman et al. 1985), (Parasuraman et al. 1988).

The measurement of service quality from the client's point of view forms the basis for this method. It takes into account a number of features characteristic of the service in question. Before the client experiences the service, he builds expectations for the service and its quality (expectations quality). The expectations are shaped by e.g. previous experience, exchange of information, personal needs and beliefs. While making use of the service, the client compares his expectations to what is being offered to him (perceived quality).

The service quality Q is calculated to be the difference between the perceived service quality P (P – Perception) and the expected (ideal) service quality E (E – Expectation):

$$\mathbf{Q} = \mathbf{P} - \mathbf{E} \tag{1}$$

A negative result, P < E, means that the client's expectations have not been fulfilled and the provided service does not satisfy the client (unsatisfying quality). A positive result, P > E, means that his expectations have been surpassed (surprising quality). In case when P = E, his expectations have been fulfilled (satisfying quality).

The methodology of SERVQUAL makes use of two surveys, each containing 22 appropriately selected statements which are assigned to 5 categories (dimensions) of the service. In both surveys, respondents decide with the help of the Likert's scale to what extent they agree with the presented statements. The first survey, given to the client before he makes use of the service, aims to assess his expectations for the service quality and to determine value E. The client assesses a service which is ideal in his opinion. The second survey, which is based on the same statements but this time regarding a specific service, aims to assess the perceived service quality and to determine value P.

The statements included in the abovementioned surveys are assigned to five categories (dimensions) of service quality (Parasuraman 1988):

- tangibles the appearance of premises, equipment, mass media, staff,
- reliability ability to provide solid and trustworthy service,
- responsiveness speed of acting and reacting to the demands of service recipients,
- assurance qualifications and expertise of the staff; ability to rouse the client's trust,
- empathy identification with the client's needs.

In the survey, the statements are grouped into sets of 4 or 5 so that each set can be used to measure one of the abovementioned categories. At the third stage, the client is asked to divide 100 points between the five categories thus indicating their weight in creating service quality.

Survey results can be interpreted in two ways. The first interpretation makes use of the so called unweighted SERVQUAL result, which is the difference between arithmetic means of perception and expectations results received from all respondents for all the statements or only those included in specific categories. The second interpretation makes use of the weighted result. Within a given category, the received responses are weighed with the points assigned to the category by the client.

Both ways of interpretation allow us to detect variances (gaps) which may appear between perceived and expected service. Therefore, we are able to indicate the areas in which the client is dissatisfied with the service, assess importance of each category in the eyes of the client and take steps to improve the service.

The categories suggested by the authors of the method are by no means universal. It should be remembered that every type of service, including distance education, is unique. For this reason the classic method needs to be modified by means of adjusting it to the service features and the service provider's needs e.g. by offering own categories and survey statements.

The usefulness of SERVQUAL for e-learning also results from the service quality model adopted by the method and the model-related concept of gaps (variances) (Parasuraman 1985). The gaps describe situations in which the provided service quality differs from the service quality expected by internal or external client. Such gaps may appear at any stage of the service life cycle. They will also appear in the process of e-learning so they should be taken into consideration during the implementation stage.

Drawing on the conducted research, the authors of the SERVQUAL tool enumerated five gaps concerning service quality.

- GAP 1. The difference between the client's expectations and the way in which the organization authorities perceive these expectations.
- GAP 2. The difference between the client's expectations as perceived by the authorities and the service specification.
- GAP 3. The difference between the specified and provided service.
- GAP 4. The difference between the provided service and the service promised by an organization.
- GAP 5. The difference between the expected and perceived service.

## 4. SERVQUAL AND THE E-COURSE

SERVQUAL is not only a tool allowing us to evaluate service quality from the client's point of view, but it also helps to analyse the factors which have influence upon the service – both at the level of the whole organization and at the level of direct contact between the client and the service. Thanks to its multi dimensions, the method can be applied to research problems related to e-education quality which appear at the stage of incorporating and implementing e-learning in a higher school and, later, during online classes (Kucharczyk et al., 2011).

#### Table 1.

DIMENSIONS	FACTORS
TANGIBLES	• course design,
	• funcionality of the platform,
	• universality of the platform (works on most popular systems),
	• e-content,
	• information about the course.
RELIABILITY	• time schedule,
	• teacher's reliability,
	• teacher's concern about the opinion of stu- dents,
	• accessibility of the content,
	• technical suport.
RESPONSIVENESS	• information about the rules concerning participation in the course,
	• reaction to the students' needs,
	• communicative skills of the teacher,
	• composure and patience of the teacher.
ASSURANCE	• teachers expertise,
	• teacher's objectivity,
	• teacher's e-qualifications,
	• usefulness of the e-content.
EMPATHY	• individual approach to the student,
	• teacher's manners,
	• moderation of e-discussions,
	• understanding the students' problems,
	• motivating the students.

#### **Dimensions of an e-course**

Source: Own elaboration

Due to its multi-dimensionality, the method was chosen to assess the quality of an ecourse measured by the level of satisfaction of the course participants, i.e. the students. The e-course is the key element of e-learning. On the one hand (technical), it is a finished "product" ready for the student (client) to use. On the other (functional), it is the process of providing teaching services by the teacher.

At this stage, the focus was on indicating, for the selected e-course, the size of gap 5. The gap is the difference between the client expectations and his perception of the obtained service. The size of the gap will therefore tell what the expectations of the student were with regard to a perfect course and how these expectations were fulfilled in the course in which he participated. As a result, the analysis of this gap may indicate the places where changes should be made to improve the e-course.

At the same time, the size of the gap is particularly important, as an e-course is the end result of a series of activities connected with, for instance, organization, marketing, methodology, and general operation of e-learning. It will, therefore, also indirectly show the students' opinion about the whole e-learning system in a given university.

The research into the students' satisfaction with the e-course was carried out using the solution proposed by the authors of the method: two surveys, each containing 22 statements assigned to the five dimensions (categories).

Table 1 shows the adopted dimensions of the e-course quality. For each dimension, the factors which may constitute specific criteria for assessing the quality of the e-course were indicated. These factors are the basis of the statements listed in the surveys addressed to the students, the e-course participants.

## **5. CASE STUDY**

The SERVQUAL method was used to assess the quality of an e-course conducted at the Department of Mechanical Engineering and Computer Sciences of Czestochowa University of Technology. The course was delivered via the MOODLE platform. There were 34 participants who were asked to take part in the research and complete the surveys, respectively before the course began and after it ended. The surveys were anonymous.

Each survey consisted of 22 statements. The first contained statements relating to a perfect e-course. The second contained the same statements, but referred to the actual e-course. For each statement the student was to allocate a numeric value, best reflecting his feelings. The study used the seven-grade Likert scale. The scale consists of seven answers, arranged in the order from completely negative (1 - strongly disagree) to the total acceptance (7 - strongly agree). The central response was the most neutral (4 - I have no opinion). The maximum value allocated by the respondent was thus 7, and the minimum -1.

After collecting the surveys, the calculations were carried out in stages. For each i-th pair of statements, average values of  $e_i$  (perfect e-course) and  $p_i$  (actual e-course) were determined by dividing the corresponding amount of points by the number of students. The  $q_i$  value was determined as the difference between  $p_i$  and  $e_i$ .

Then, the  $Q_j$  value was determined for each j-th dimension. Value Q is the average value of Q in the j-th dimension, taking into account the factors specific to this dimension. The total value of Q (e-course quality) was obtained by summing up  $Q_j$ , and then dividing the result by the number of dimensions. The results obtained for dimension 1 (tangibles) are shown in table 2. The results are shown in fig. 1.

The analysis of the data presented in table 2 and in figure 2 shows that the greatest expectations of students related to e-materials ( $e_4 = 6.82$ ). Unfortunately, the same factor also had the largest gap:  $q_4 = -1.57$ .

The size of the gap can be explained by the fact that a tool commonly used by students in the process of finding information is the Internet. It offers a wide variety of multimedia content: from the text and hypertext, through illustrations and photos, tables and charts, flash animation, audio and video, to ones which are sometimes difficult to define clearly (blogs, podcasts, tools such as Glogster, Voxopop, Padlet any hundreds of others). It can therefore be assumed that students' expectations as to the diversity and attractiveness of e-course content had been firmly shaped by their experiences with the Internet. And what the students found in the e-course was mainly PDF files. There was no visual (video) content where, for example, they would have a chance to see the teacher.

#### Table 2.

Dimension 1 – e-course tangibles				
	e <sub>i</sub>		<b>p</b> i	$\mathbf{q}_i = \mathbf{p}_i - \mathbf{e}_i$
1. The page of a perfect e- course should be attractive and readable.	6,60	1. The page of e-course X is attractive and readable.	6,15	- 0,45
2. A perfect platform is functional and safe.	6,06	2. The platform of e-course X is functional and safe.	5,80	-0,26
3. A perfect e-course works properly in the most popu- lar environments (Win- dows, iOS, Android)	6,15	3. E-course X works properly in the most popular environ- ments (Windows, iOS, An- droid)	5,45	-0,70
4. Perfect e-content is at- tractive and multimedial.	6,82	4. The e-content of e-course X is attractive and	5,25	-1,57

An example of the survey and the results for the dimension 1

		multimedial.		
5. Information about the e- course should be complete and comprehensible.	6,35	5. Information about e-course X is complete and comprehensible.	5,18	-1,17
	Average quality $Q_1$ for dimension 1		-0,83	

Source: Own elaboration





#### Source: Own elaboration

It is worth noting though that, in the opinion of the author of the course, the content was very interesting. The author focused on the substantive content of the materials and did not attach special attention to the way in which they were "given" to students. Thus, with regard to the e-content, the basic direction for improvement was indicated – there should be more variety and modality in the e-materials.

The least important to the surveyed students was the functionality and safety of the platform by means of which the course was delivered ( $e_2 = 6.06$ ). This factor also had the smallest gap,  $q_2 = -0.26$ . Perhaps what we can observe here is the phenomenon of "invisible quality" - if there are no problems or disorders, the client does not see any potential problems. During the course, there were no problems related to the platform safety or functionality.

For each dimensions, table 1, the average value of quality Q<sub>i</sub> is shown below:

- $Q_1 = -0.83$  (*tangibles*);
- $Q_2 = -0,54$  (*reliability*);

- $Q_3 = -0,70$  (responsiveness);
- $Q_4 = -0,35$  (*assurance*);
- $Q_5 = -0,41$  (*empathy*).

The smallest difference between the expected and the perceived quality appeared for dimension 4 - assurance (reliability and professionalism of the teacher). It can be assumed that the students highly appreciated, among others, the teacher's knowledge and objectivity.

For dimension 3 (response to the requirements of students) the size of the gap results mainly from the teacher's delays in responding to students' queries.

Frequently, the students had to wait for longer than the declared 48 hours. Some of the students perceived this as the unreliability of the teacher. The teacher excused himself with an accumulation of teaching duties in the given semester and the lack of time. The teacher, who conducted an e-course for the first time and declared an individual approach to each student, did not realize the amount of work which was associated with running the e-course.

The total value of the e-course quality Q was - 0.57. At this stage of the application of the SERVQUAL method to evaluate the quality of an e-course, it is difficult to interpret this result. Since it is negative, it can only be concluded that the students were not fully satisfied with the delivered e-course. Another survey conducted for the same course in the next academic year would indicate the direction for improvements in the quality of the e-course. However, it should be remembered that the assessment made by the students is subjective. Students represent different levels of intellectual capacity, different systems of values, different approaches to becoming engaged in the process of acquiring the knowledge (Seredocha, 2007). Consequently, the next year students may interpret the statements in the survey in a totally different way. The "quality" of students could result in a different allocation of the points. Hence, it is recommended to survey a larger group of students, as the increase in the number of respondents should provide a more objective result.

The presented results relate to the so called unweighted SERVQUAL method. The quality of the e-course was determined as the difference between the perceived and the expected quality. At the current stage of the research, the students did not complete the third survey in which they would divide a specific number of points between the defined dimensions. This would enable to order the dimensions in terms of their importance for students. The unweighted version of the method only allows to determine which e-course dimensions (component factors) should first be analyzed in order to better suit the student – the e-course recipient.

#### 6. CONCLUSION

The quality of services provided by institutions of higher education, including elearning, is becoming increasingly important. It is becoming one of the measures of its position on the market. The challenge is to meet the expectations of our clients. The SERVQUAL method is a tool for decision making with regard to the quality of services from the client's perspective. Due to its multi-dimensionality, the method may be particularly useful for researching the quality of e-learning. In the SERVQUAL method it is possible to connect the system approach, looking at issues of e-learning in the context of the whole university, taking into account the client's point of view and preferences. It also allows to monitor the quality improvement in a specific time and in specific areas of e-learning.

#### REFERENCES

- Walasek, T.A., Kucharczyk, Z., Morawska-Walasek, D., 2011: Assuring Quality of an E-Learning Project Through the PDCA Approach, Archives of Materials Science and Engineering, Vol.48 Iss.1, 2011, pp. 56-61, ISSN 1734-8412
- Zając, M., Stanisławska-Mischke, A.,K., 2009: *The scope and criteria of e-courses quality evaluation*. Selection of e-education issues, WNT, Warszawa, 2009, pp. 91-99, ISBN: 978-83-204-3534-4 [In Polish]
- E-course evaluation criteria, available at http://www.sea.edu.pl/kryteria/ (accessed on 01 September 2013) [In Polish]
- Parasuraman, A., Zeithaml, V.A., Berry, L.,L., 1985: A Conceptual Model of Service Quality and Its Implications for Future Research, Journal of Marketing, 49/3, 1985, pp. 41-50, ISSN: 1547-7185
- Parasuraman, A., Zeithaml, V.,A., Berry, L.,L., 1988: SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality, Journal of Retailing, 64/1, 1988, pp. 12-40, ISSN: 0022-4359
- Kucharczyk, Z., Walasek, T.,A., Morawska-Walasek, D., 2011: The quality of e-learning - the Servqual method. In: Use of E-learning in the Developing of the Key Competences, Monograph, Sc. Editor: E.Smyrnova-Trybulska, University of Silesia in Katowice, Katowice-Cieszyn, 2011, pp.317-330, ISBN: 978-83-60071-39-7
- Seredocha, I., 2007: *How to speed up the evolution of the university*, available at http://www.forumakad.pl/archiwum/2007/10/38\_jak\_przyspieszyc\_ewolucje\_u czelni.html (accessed on 01 September 2013) [In Polish]

## ATTITUDES OF FUTURE TEACHERS TOWARDS E-LEARNING – INSTRUMENTAL CASE STUDY

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**Abstract:** Distance learning course Media in Education was carried out in the academic year 2012/2013 for full-time 61 students and 25 part-time students Polish Philology teaching specialties. Each student was required to put in the resources Power Point presentation and take one activity. It was treated as two hours of classes. Resources have been available to 17 students Library and Information Science, who were preparing to become teachers. Classes were held in a blended learning system, in addition to 10 hours of exercises for stationary cycle and 6 hours for part-time studies. Most undertaken were such activities as: forum, quiz, glossary of terms, rarely voting and chat. It turned out that the media competences are sufficient for students to participate in the e-course. Probably now some of them were able to conduct e-classes.

Keywords: *Media in Education*, Polish language teaching, prospective teachers, forum, e-course

#### INTRODUCTION: MEDIA IN EDUCATION OF PROSPECTIVE TEACHERS OF POLISH LANGUAGE ON PEDAGOGICAL UNIVERSITY IN CRACOW

It was the first distance learning course at the Institute of Polish Philology. It was possible, because in the academic year 2012/2013 at the University was launched MOODLE Platform. It was also the first e-course run by the author of this text.

Developed in 2007, the syllabus of the course *Media in Education* did not provide distance learning classes. They were scheduled in the audiovisual room with browsing network resources and creation of teaching materials by the teacher and students. Presentation by the teacher was supposed to provide instruction. However, presentations made by students were designed to serve the exchange of experience and dissemination of inventive use media capabilities for teaching.

#### 1. RULES OF PROCEDURE AND PROGRAM OF THE COURSE

#### 1.1 Rules of procedure

Students were informed that the course allows them to get to know how the platform Moodle works (types of materials, possible activities), with which they can create content, take activities and conduct classes in a remote form, in order that didactic process may be effective (Ślósarz 2013 II: 1). Terms and conditions contained formulations:

- 1. The password is kept confidential (...).
- 2. The user profile should contain real data (...). Login should consist of letters and numbers because of security.
- 3. The Student must have access to the Internet and programs: for playing of media files and view "Adobe Acrobat" documents (...).
- 4. Course participant must also have access to Moodle Platform at Pedagogical University (...).
- 5. During the course, students can communicate synchronously (chat) and asynchronously (discussion forum, news).
- 6. We present only materials related to the course.
- 7. Entering false personal data, obstruction another person work, posting the offensive or obscene content will result in blocking the student's account. This behavior is governed by article. 141 of the "Code of offences" (Ślósarz 2013 I: 1).

#### **1.2 Program of the course**

E-course *Media in Education* was prepared in January 2013, that is to say at the end of the winter semester of the academic year. Full-time students held necessary number of hours. Distance learning course was designed to familiarize them with this form of work and was to be complementary. In the case of part-time students substituted traditional two-hour classes. For students of Scientific Information and Library Science e-course *Media in Education* was the repository of examination materials (presentations of the lectures and readings), and the ability to observe the work of senior colleagues from second degree teaching specialization.

Student were asked to take two activities: insert into second module own presentation, based on a reading as the project of a lesson or series of classes and perform at least one task, chosen from the following modules:

- 1st. *Forum of Students Presentations*. Students have had possibility to put here their presentations. They could discuss their materials on the forum.
- 2nd. *Changes in Teacher Functions* related to psychosocial and technical skills needed to carry out distance learning. Students were asked to read indicated by the hyperlink text Eve Lubina *Function Changes of the Teacher in Teaching at a Distance* (Lubina 2004). Then they had to enter a post on the forum and name the three most important psychosocial

competences of the distance learning teacher, as well as sort out his skills from basic to the most complex (creative expert, the substantive knowledge, methodological knowledge, wisdom). It was also necessary to develop a didactic project that can be implemented using distance learning tools. Student also had to respond once to the post one of colleagues.

- 3rd. Web Quest this method of teaching was presented in the specified hyperlink article by Mark Szafraniec Web Quest as an Interactive Methods of Training Students and Adults at a Distance (Szafraniec 2009). The student's task was reading this text and participating in chat room. It was necessary to replace developed by the Web Quest skills, to present components of instruction for students starting work this way and offer them topic to developing during the lesson or as the homework.
- 4th. *E-Didactic Tools* were related to teaching with use interactive whiteboard (Agrafcompol 2010), Mind Maps (Baj), the Hot Potatoes (Filmy Szkoleniowe [Training Films] 2012), the establishment of a blog (Ms Anna Kostro 2011) and the need of the use of electronic tools in the work of the teacher (Levyznin 2010). After seeing the material the student had to take part in the vote on the usefulness of these tools.
- 5th. *Resources of Portal "Scholaris"* have focused the attention of students on the designated hyperlink educational portal and various its features, especially connected with Polish Language teaching. The student's task was to examine its resources and functions, and to propose the use of its in education. The statement on this subject had to be sent to the discussing forum.
- 6th. *Polish Language Applications* include a variety of programs to help organize the process of distance learning. Students task was to read hyperlinked list *Guide to Web 2.0 applications in education* ("E-Mentor" 2013). The Student had to choose two of them, and formulate their own didactic proposal, based on them and connected with obligatory reading.
- 7th. *Tutorial to Conducting Distance Learning* referred to tutorials for leading e-courses posted on the university platform. The students' task was to send on the forum a post with the description of the steps that you must perform to create a course. It was also necessary to specify the skills of the Polish language teacher, who lead distance learning.
- 8th. *Television Glossary of Post-Modern Polish Language Teacher* included done by two student presentation, based on the book by Wieslaw Godzic (Godzic 2004). The student's task was to formulate a post for glossary as a definition of the term, a description of the phenomenon, teacher reflection, observations, technical notes, personal thoughts, using names of channels, programs, names of presenters and celebrities, etc. Passwords were automatically signed by the student's first and last name, and the other students had possibility to comment on it.

- 9th. *The List of Sources Useful Teacher for Distance Learning* referred to 62 print and online texts, relating to various aspects of distance learning. The student's task was to choose the five most useful teacher to e-course and justification of choice provided in the forum post.
- 10th. *Audiodidactics in Polish Language Teaching* it was referencing to the material contained on the portal by Lechoslaw Hojnacki (Hojnacki 2013). Student had the task to solve the quiz. He had two approaches, there were an average rating.
- 11th. American Courses of Distance Learning this module contained a hyperlink to more than two thousand courses provided by the Massachusetts Institute of Technology. The Student needs to watch two, conducted in whole on-line. They were indicated by hyperlinks and focused on education. The student's task was to comment on the forum about their suitability for Polish language teacher or the ability to inspire him.
- 12th. Didactic proposal of Student: "The Doll" Dialogue with Contemporaneity contained developed by student Maria Szumera project of contemporary interpretation of the novel The Doll [Lalka] by Bolesław Prus. Students were invited to express their opinion and to present similar didactic proposals.
- 13th. *We Evaluate this Course* was the space in which the student had possibility to assess the didactic suitability and substantive quality of the course. It was possible to speak at the forum or fill out a survey.
- 14th. *Exam Materials for INiB* [*SIaLS*] *Students* included examination issues and presentations made by the authoress of the course and students of Scientific Information and Library Science. They have had possibility to view all materials and also to communicate in forum placed in this module.
- 15th. *Internet Café "Under the Golden Androids"* included a forum to discuss topics not related to the course.

#### 2. MULTIMEDIA RESOURCES AS DIDACTIC MATERIALS

#### 2.1. Multimedia means

The course included text materials collected in 15 modules. They include: 24 PDF documents (including 18 made by students), 9 Power Point presentations made also by students. Hyperlinks were directed to three PDF documents, to three portals, to one open e-course, to four videos, to seven tutorials and to one Flash presentation.

So rich resources were formed with the involvement of students. They were collected over time. At the start of the course for full-time students was prepared 9 modules. For part-time students have been added modules 4, 10-12, 14-15.

#### 2.2. Multimedia tools

The course includes 13 discussion forums, chat, glossary, quiz, one voting, one survey. The leading used also *The News Forum*. She posted in it 5 posts. They were related to organizational problems, evaluation and operation of the course.

Some students had technical problems with entering of the posts. They carelessly read instructions. Not everyone knew that a post can be edited only by 30 minutes, so some posts were unfinished. Students asked leading to delete it and re-edited entries. The interest in the various forums is presented below.

#### Table 1.

Name of discussion forum	Number of entries	% of entries	Average rating
Changes in Teacher Functions	90	56.25	7.15
Forum of Students Presentations	44	27.05	7.36
The List of Useful Sources for Distance Learning Teacher	12	7.5	9.14
We Evaluate this Course	9	5.6	-
Didactic proposal of Students: "The Doll" – Dialogue with Contemporaneity	3	1.87	9.50
Polish Language Applications	1	0.6	4
American Courses of Distance Learning	1	0.6	3
E-Didactic Tools	0	0	
Tutorial to Conducting Distance Learning	0	0	
Resources of Portal "Scholaris"	0	0	
Exam Materials for INiB [SIaLS] Students	0	0	
Internet Café "Under the Golden Androids"	0	0	

Percentage distribution posts in discussion forums and average ratings

#### Source: own elaboration

Most of the posts were placed in the forum about how to change the function of the teacher in teaching at a distance, because it turned out, that this topic is crucial. Interest in *Forum of Students Presentation* resulted from the fact that it was obligatory. Presentations were made in groups, so their number (9) is smaller than the number of participants. Other forums had attracted moderate interest. In the dictionary were developed 24 concepts. But only one person participate in the vote, no one did participate in the chat room (they were not scored). This shows the pragmatic-minded students, who were seeking the fastest forms of assessment.

## 3. QUALITY OF ASSESSMENT

Course *Media in Education* according to syllabus ended without ratings. Student's activity in the course, however, was assessed in different ways. Forum posts and concepts contained in the dictionary were discussed by the teacher and students, and rated on a scale of 0-10 p. Student received max. 8 points for the substantive value of the task, and the other two for the manner of their presentation (using of technical functionality – especially hyperlinks and graphics, technical resourcefulness, clarity, correctness of the language). Quiz was evaluated automatically with an accuracy of two decimal places on a scale of 0-100%. To pass the module it was necessary to get at least 8.5 points. So conditions to pass the course was: posting the presentation and correct solution of a task or correct editing of the post. Part-time students have had the opportunity to work instead absence. Performing any one activity meant the execution one hour of the classes.

Quiz consisted of 6 questions. 15 students solved them in 27 attempts (3 were allowed). Average rating stood at 77.72%.



Figure 1. Results of quiz Audiodidactics in Polish Language Teaching Source: Anna Ślósarz Media in Education<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> Anna Ślósarz Bar graph of the number of students results in different numerical ranges, available at http://moodle.up.krakow.pl/mod/quiz/report.php?id=4308&mode=overview&attemptsmode=0&qmfilter=0&reg radefilter=0, (accessed on 30 July 2013) [In Polish]

The critical incident turned out to be a student question. She asked why different answers to the same question are considered to be correct during the following approaches to the quiz? It turned out that this was due to the effects of ratings rounding, in this case, 75% (Partially Correct) to an integer in order to obtain greater transparency on the scoreboard. This resulted in a equalization 75% and 100% rate. In summing up of the results the system showed accurate values, which gave rise to further doubts of students. Introducing two decimal places lead to the system displays the *Mark 0.75 of 1*, and *Mark 0.05 of 1* etc.

Teacher was unable to set automatic aggregation of ratings. Completion of the course was established on the basis of the grade book or even post displayed on the screen or printed and analyzing them in the presence of the author. Sometimes student placed the post on forum just before coming on call duty of teacher. It was due to the fact that the task execution dates have not been set.

## 6. CULTURAL, SOCIAL AND LEGAL ASPECTS OF THE COURSE

The course not mobilized all students to take an interest in new technologies in the area of the teaching of Polish language and literature. 10 students did not participate in it, even though they logged in and were co-authors of the presentation. Some of these presentations were shown during classes, but were not included in the course. Two students were not logged. Therefore, not all students completed the course on time.

#### 6.1. Psychological aspect of the course

The course was treated as a kind of test. Students were aware that their entries will be on the University Platform. That's why they tried to carefully form language and to be kind towards others. Posts have'nt spelling mistakes or major defects language.

#### 6.2. Teacher-student and student-student relationships

Mutual student relationships were very kind. Ideas of colleagues were praised. However, there have been no polemic or discussion longer than 8 posts in the thread. Most popular was about *The Doll*. Developed 17-21 January. However, after a proposal from the leading to make the contemporary contexts of discussion today, break up, and the last entry appeared only on 30 January 2013. It was a critical incident. It revealed that lead's presence in the discussion may inhibit it. This is especially true when the course is highly formalized due to the short duration.

An evaluation survey filled more than a dozen full-time students and three part-time. All positive and highly evaluated the course. The most interesting for students was the search tools useful in e-learning, presentations and opinions of colleagues, preparation own comments. Some students found login process as too complicated in their opinion. Other were surprised by the numerous statements by other students (e.g. one student in 7 different modules).

#### 6.3. Iconography in the service of teaching

Teacher inserted a photo showing a woman working at a computer. It was copied from the public Microsoft Office resources and placed as invitation of students to be active. The photograph reminded a university laboratory, where classes were held in the traditional form. But students have then access to the Internet and the ability to view and use the mentioned tools and resources. The choice of photograph decided also hairstyle of the woman, similar to used by the teacher.



Figure 2. Image from the course *Media in Education* 

Source: "Microsoft Office"<sup>2</sup>

However, students rarely posted graphics in their verbal texts and presentations. They do not use them, even when proposed classes about Stanislaw Ignacy Witkiewicz<sup>3</sup> or contexts with graphics, film, music, sightseeing<sup>4</sup>. That's why teacher twelve times demanded them. Twice she explained how to insert graphics and posted them in her posts. Twice she asked not to insert images with watermark. She drew attention to the bad copy, and improper downloading graphics by students resulting in improper display of the image. 21 times she asked to insert hyperlinks to graphics or to activate hyperlinks. These requests were not always met.

Graphics inserted by students usually reflected dominant in the MSM point of view. The students did not realize their ideological character. Succumbed to the iconic violence. They mistook vintage photographs with contemporary. They have forgotten about providing sources<sup>5</sup>. Few have been able to use free resources and integrate them with their own messages.

<sup>&</sup>lt;sup>2</sup> "Microsoft Office" Woman working with computer available at http://office.microsoft.com/plpl/images/results.aspx?qu=edukacja&ex=1#ai:MP900442309 (a Open Source license), (accessed on 29 August 2013).

<sup>&</sup>lt;sup>3</sup> I. Pawlusiak *Exploration of Witkacy available at* http://moodle.up.krakow.pl/mod/forum/discuss.php?d=118, (accessed on 30 August 2013).

<sup>&</sup>lt;sup>4</sup> E. Goczał Crossing the Cinnamon Shops – an Introduction to the Work of Bruno Schulz available at http://moodle.up.krakow.pl/mod/forum/discuss.php?d=146, (accessed on 30 August 2013).

<sup>&</sup>lt;sup>5</sup> A. Kuźma *The Situation of the Jews in World War II available at* http://moodle.up.krakow.pl/mod/forum/discuss.php?d=360, (accessed on 30 August 2013).



Figure 2. Functional graphics of course Media in Education

Source: A. Kuźma, M. Krzyżak, A. Wszeborowska "TV After Big Brother"<sup>6</sup>

## CONCLUSION: SUCCESSFUL EXAMPLE OF E-LEARNING OF PROSPECTIVE TEACHERS

Computer training and distance learning are important for prospective teachers of Polish Language. The course allowed for an exchange of views, mobilize to the activity and develop key competences of students, especially digital competence, social and civic competences, communication in the mother tongue and in English.

The teacher can present his own opinion about ideas of students. Mobilize students to discussion. Students learned ways to create and share resources well how to take activity in the course. They became convinced to use distance learning in their own teaching practice.

#### REFERENCES

A Guide to Web 2.0 Applications Used in Education, available at http://www.e-mentor.edu.pl/aps/index, (accessed on 18 January 2013) [In Polish]

<sup>&</sup>lt;sup>6</sup> A.Kuźma, M.Krzyżak, A.Wszeborowska TV After Big Brother, available at http://moodle.up.krakow.pl/mod/forum/discuss.php?d=286, (own elaboration based on resources "Microsoft Office" under Open Source license, accessed on 29 August 2013).

- Agrafcompol, 2010: *Example of Application of Interactive Whiteboard* "*Interwrite*" available at http://www.youtube.com/watch?v=v6nCBFeZUmw, (accessed on 18 January 2013) [In Polish]
- Baj, A., 2010: *Mind Maps in Ten Steps*, available at http://www.youtube.com/watch?v=8BgkWIEeX-M, (accessed on 18 January 2010) [In Polish]
- Filmy Szkoleniowe [Training Videos], 2012: *How to Make a Crossword in Hot Potatoes*, avaliable at http://www.youtube.com/watch?v=Rd4D\_8bwPjo, (accessed on 18 January 2012) [In Polish]
- Godzic, W., 2004: TV and its Genres after the Big Brother, Universitas, Kraków, ISBN 83-242-0400-8 [In Polish]
- Kostro, A., 2011: *How to Start Your Own Blog. Guide, part I*), available at http://www.youtube.com/watch?v=VeOOQ8Xd1A4, (accessed on 18 January 2013) [In Polish]
- Levyznin, 2010: *Did You Know?* 1.0 *without amendments*, available at http://www.youtube.com/watch?annotation\_id=annotation\_917942&feature=iv &src\_vid=cK527YlYSRc&v=65-USMzRtsk, (accessed on 18 January 2013) [In Polish]
- Lubina, E., 2004: *Changes in Teachers Functions in Distance Learning*, "E-Mentor", avaliable at http://www.e-mentor.edu.pl/artykul/index/numer/6/id/80, (accessed on 18 January 2013) [In Polish]
- Ślósarz, A., I, 2013: *Media in Education,* available at http://moodle.up.krakow.pl/course/view.php?id=150, (accessed on 30 August 2013) [In Polish]
- Ślósarz, A., II, 2013: Regulations and Syllabus of the Course "Media in *Education*", available at http://moodle.up.krakow.pl/course/view.php?id=150, page 1, (accessed on 30 August 2013) [In Polish]
- Szafraniec, M., 2009: Web Quest as an Interactive Method of Students and Adults Distance Education, available at http://www.kul.pl/art\_19235.html, (accessed on 18 January 2013) [In Polish]

## CONSTRUCTING E-LEARNING TOOLS FROM HEURISTIC METHODS: MULTIPLE WHYS, CIRCLE OF ANALOGIES AND STEPWISE CONVERGENCE

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Abstract: I discuss various methods which may benefit from online implementation, supporting e-learning in the area of creativity and effective thinking at all educational levels, from kindergarten to graduate programs. All procedures comprise a virtual laboratory, capable of generating actual creative solutions to real problems. Tools for creative thinking may be implemented as online procedures allowing the user to conduct heuristic group sessions. I provide examples of individual-user heuristic methods (multiple Why? questions, circle of analogies) and a group-based method (discussion 66 which involves stepwise convergence of ideas generated by semi-independent subgroups).

Keywords: creativity, e-learning, heuristics, innovation

#### **INTRODUCTION**

Specialized e-learning tools for managing creativity allow us to combine critical and rational thinking which relies on clarity and explicitly defined criteria, with heuristic methods. Some of such methods are epitome of creative disorder, but others may be based on orderly, almost algorithmic approaches (e.g. Duran-Novoa et al., 2011). I believe that both types of methods, if applied with rigor ("disciplined imagination", Cornelissen 2006), may be implemented in various e-learning tools and perform functions which enable creativity (see also Barak 2013; Chang 2011). In this paper I describe both the logic and mechanics of selected heuristic methods and ask which of their features are amenable for implementation in an online environment (Jasieński 2012a).

# 1. MULTIPLE "WHY?" QUESTIONS – TRAJECTORIES OF ANSWERS FOR E-LEARNING

The same question "Why?" is asked repeatedly because at each stage the answer it yields is different. This strategy allows us to probe deeply into the causes of problems and, what is equally important, branching points in this path are created when several answers are provided to a given "Why?"; with a single answer, a straight path is simply elongated. A branching system thus arises and it explores a multitude of viewpoints and aspects of the problem. Some of the paths explore purely theoretical or abstract aspects (such as: ethical, philosophical, aesthetic) and other paths may lead to practical issues, connected with technological, managerial or financial details.

#### 1.1 An example

The price of our product is too high, compared to the products of our competitors. Why? [I provide three possible answers, each followed by a sequence of several possible trajectories of answering.]

Answer A (one of many possible): Because the production process is very costly. Why?

Answer A-1: Because costs of electricity are very high during one of the stages of the production process. Why?

Answer A-1-1: Because that stage occurs during the time when electricity is more expensive. Why?

Answer A-1-1-1: Because the production process begins always at the same time, in the morning. Why?

Answer A-1-1-1: Because the necessary substrate arrive always during the night. Why?

Answer A-1-1-1-1: Because the traffic is much lower during night hours. Why? STOP

Answer B (one of many possible): Because the material used in its production is very expensive. Why?

Answer B-1: Because we use as one of the components, to improve resistance to scratching of the surface of our device, a chemical compound which is very expensive. Why?

Answer B-1-1: Because there are no known chemical compounds with similar properties. Why?

Answer B-1-2: Because this compound is mined in only one location in Siberia and imported, which makes it expensive. Why?

Answer B-1-2-1: Because trade tariffs for imports of this component are very high. Why?

Answer B-1-2-1-1: Because the Congress wants to protect the local companies which produce alternative compounds. Why? STOP

Answer B-1-2-1-2: Because raising trade tariffs is part of a political conflict between two countries. Why? STOP

Answer B-1-2-2: Because there are no cheaper methods of obtaining this compound which is know to occur in basalt rocks in Alaska. Why?

Answer B-1-2-2-1: Because a new research grant proposal aimed at developing such methods was rejected by a granting agency. Why?

Answer B-1-2-2-1-1: Because the best scientist left the research team. Why?

Answer B-1-2-2-1-1-1: Because she entered a convent. Why? STOP

Answer B-1-2-2-2: Because the previous research project showed that all known methods of technological processing of basalt rocks are not effective in this case. Why?

Answer C (one of many possible): Because the packaging of this product is handmade and old-fashioned. Why?

Answer C-1: Because the marketing campaign for this product was targeting mostly older clients. Why?

Answer C-1-1: Because it has been decided that our firm should be directing its attention towards such clients. Why?

Answer C-1-1-1: Because we have assessed that the economic potential of older clients will grow in the near future. Why?

Answer C-1-1-1: Because of the demographic trends, i.e. the society is getting older. Why? STOP

#### 1.2 Benefits of an e-learning implementation

Software facilitates keeping track of the growing tree of answers, which quickly becomes unwieldy with many branching idea threads. The system should be able to provide output in the form of a listing of answers. However, the example shown above illustrates how difficult to use and confusing a simple listing of proposed ideas can be. Clearly, a more intuitive visualization of the results is essential for an e-learning system to provide any advantages. Figure 1 shows the simplest approach at bringing order to the generated tree of responses. Each of the boxes in the flowchart should be clickable, with an option of becoming a new branching point from which a new branch (idea thread) begins.

Each end-point is marked with a "Stop" indicator proposed by a participant and accepted by the majority of others. Subject to assessment are only end-points of each trajectory of questions. Such social component, when the participants decide about

the pattern of branching and generation of ideas, and also when software allows for accumulation of feedback for each idea thread, is worth implementing. Also, the icons with answers may have size proportional to the positive interest they generate among the users (for example, the more votes, the larger the size). This element ensures that the feedback received from the community of users is dynamically built into the visual representation of the proposed solutions.



Figure 1. A flow-chart-like structure of branching of responses to questions "Why?" from the example above

Source: Own elaboration

Finally, one could propose quantitative indexes measuring the rate with which alternative answers are generated for each "Why?" question, thus enabling the use of such e-learning tool for educational and psychological research (see e.g. Butler & Kline 1998; Vessey & Mumford 2012).

#### 2. MANAGING METAPHORICAL THINKING

Deep exploration of various aspects of the focal issue may be achieved through methods based on a controlled and rigorous use of imaginative analogies (Cook & Gordon 2004; Hey et al., 2008). This sounds almost like a paradoxical statement: analogies and metaphorical thinking are usually not compatible with disciplined and methodical analysis (Indurkhya 2007). However, analogy-based methods, nicely summarized and developed for the Polish readers by Nęcka (1994), illustrate that one can combine both ways of thinking. I consider below how they could be implemented in an IT-based environment.

As Oswick et al. (2002) point out, metaphors (which are forms of analogies) may serve either as tools which strengthen our similarity-based "cognitive comfort zone" or, through the use of dissimilarity-based approaches (anomaly, paradox, and irony) may help in building the "cognitive discomfort zone". They argue that is where the truly creative solutions lie. One may also capture the difference between these alternative ways of dealing with analogies by describing two strategies.

First may be described by the phrases "make strange into familiar" or "tame the unknown" (Gordon 1961, Nęcka 1998, 2001). It makes it easier to understand or explain complicated concepts or things by comparing them to concepts or things that are either well understood (e.g. steam engine), familiar (even if not understood, e.g. love, weather, stock market behavior or internet) or just simpler (e.g. comparisons of light vs dark, light vs heavy, light vs fatty). When one compares an optimization procedure to a trip in a mountainous area and searching for the tallest peak, this analogy captures very effectively the essence of optimization. We have made a difficult concept, the one that can be truly understood after several years of studying statistics and quantitative methods, into something the sense of which can be intuitively grasped, by comparing it to a familiar activity (a trip to the mountains). Similarly, the advanced problem of sound digitalization, i.e. a conversion of a sound wave into millions of discrete fragments, each lasting 1/44,000th of a second, can be compared to chopping dill.

Second strategy is to "make familiar into strange" – it makes it possible to see new and exciting aspects in things that are well-known or plain (Gordon 1961, Necka 1998, 2001). We are trying to inject mystery or excitement into objects, people, or issues that are so familiar or taken for granted that we are no longer interested in them. We hope to rediscover in those familiar topics streaks or echoes of fundamental and important processes, that were there forever, and that allow us to re-connect with long-forgotten values. In the process of such rediscovery, we may create new ideas that maybe will lead us to form new ways of seeing the world and, in Steve Jobs's words, "put a dent in the universe". When I say that my Macintosh laptop is like a crusader's sword with which to fight infidels (however silly or objectionable this analogy is), I try to show that my good old laptop is more than a piece of hardware, but that I try to do important educational things with it. An unexpected analogy may capture the nature of the problem more effectively than long explanations.

What is referred to as a "focal issue" could be of very diverse nature (see also Cornelissen 2004, 2005): it may be a product which is considered for commercial introduction, a person (e.g. a politician whose election campaign is being planned, a band considering a change of their image), an organizational or social problem to be solved (e.g. alcoholism, low morale of the employees, poor involvement of citizens in the life of a local community), or a controversial social issue (e.g. abortion, in vitro).

## **3. CIRCLE OF ANALOGIES**

This qualitative method, originally proposed and named "circept" by Kaufmann et al. (1975), relies on combining our ability to generate analogies with a sense of graphical order, i.e. ordering analogies in a visually meaningful diagram.

#### 3.1 The procedure

1. finding a large number of analogies of the focal concept, with being able to explain and justify each particular analogy – this step should not be just an exercise in random creativity;

2. forming pairs of analogies which represent the ends of a conceptual axis – they should be linked in a justifiable way, but may emphasize mutually exclusive or opposite ends of a spectrum of characteristics;

3. naming the most important axes with names that are meant to reflect some deep or underlying quality, that had not been obvious to us before;

4. arranging the named axes in the form of spikes of the wheel in such a way that the order of axes can be justified, i.e. two axes that are closer to each other in some dimension of characteristics (i.e. have higher relatedness) should be also closer on the circept graph;

5. adding visual representation of a quantitative criterion called by Necka (1994) "relative accuracy" to strengthen the qualitative nature of the analysis. Two analogies which form two ends of one axis do not necessarily have to be equally accurate in capturing the spirit of the focal concept. The quality (aptness, inventiveness, attractiveness, freshness etc.) of each of the analogies used in the circept is therefore assessed using some quantitative scale. As a result, the circept diagram becomes a hybrid with a radar (spider) chart, and e.g. Microsoft Excel produces radar charts that can be adopted to the circept method, with an even number of the spokes of the wheel. Such analysis, combining qualitative and quantitative elements, is much more robust and, potentially, useful.

#### 3.2 An example

The focal issue for analysis is "a grant from the European Union", as seen through the eyes of a scientist from a university or a research institute. For offices for technology transfer or for international scientific exchange to be effective in their work among scientists, it is essential that they understand all possible implications that obtaining a grant has for recipients. Such implications are not exclusively positive. Office managers must appreciate the diversity of responses to a grant that appear in the community of scientists. Only then can they design effective strategies of encouraging, overcoming scepticism and managing grant-related behaviors among the potential grant applicants.

Figure 2 shows the generated analogies, suggests how they could be paired, to create six axes, and proposes one way of arranging the axes on the diagram. The axes can

then be named, in an attempt at generalizing insights. The "maternal care – gullibility of EU" axis may reflect the underlying problem of "welfare addiction"; the "gates to heaven – gates of hell" axis represents the underlying problem with "bureaucracy"; the "ostracism-prestige" axis emphasizes the importance of "envy" as a factor.



## Figure 2. A traditional circept diagram, with pairs of analogies forming axes, each with a particular interpretation

Source: Own elaboration





Source: Own elaboration

The participants may think that, for example, the benefits from obtaining the European grant ("gates to heaven", Fig. 3) are greater (average index of quality of, say, 9.7) than the substantial troubles associated with administering the EU-related paperwork ("gates of hell", index of 7.9). Consequently, this particular axis is weighted towards benefits rather than troubles, and this may affect the conclusions derived from the circept.

#### **3.3 Benefits of an e-learning implementation**

Drawing an active (rather than purely graphical) circept diagram can be very effectively facilitated by appropriated procedures: pairs of analogies can be assigned colors, linked by axes, and added to the diagram. Positions of the axes on the diagram should be adjustable by dragging, since this step is conceptually difficult and requires many "what if" adjustments. A specialized tool for quantitative assessment of the aptness of analogies should be easily activated to allow transformation of the traditional circept diagram into the radar diagram option.

#### 4. STEPWISE CONVERGENCE OF IDEAS GENERATED BY SEMI-INDEPENDENT SUBGROUPS

During a group debate there often occurs a phenomenon of implicit agreement between the participants that one of the ideas proposed during the debate is better than others. It is usually caused by somebody's spontaneous remark, issued without much analysis. This phenomenon negatively impacts the creative potential of the entire group, since the participants unconsciously direct their creative insights into the direction suggested by that remark. Other directions of thought wither away, which results in a loss of diversity of ideas (Greenberg & Baron 2000).

One of the remedies, known as "Discussion 66" (see Denton 1999; Proctor 2002), involves splitting the group into small subgroups which then generate ideas separately and then confront them with the outputs of other subgroups. Consequently, idea generation occurs in the subgroups along independent trajectories and, therefore, the danger of becoming fixed on one particular line of thought is minimized. One could see similarity of this approach to the Delphi method (Linstone & Turoff 2002), which could be called "stepwise convergence of ideas of independent experts".

#### 4.1 The procedure

Figure 4 shows the stages forming this method which begins with receiving the description of the problem to be solved; subgroups work under time constraint (in 6-minute sessions, to motivate participants), and then present their ideas in front of the entire group. After such open discussion, subgroups return for the next session. Adopting and developing other subgroups' ideas is allowed and encouraged.

The process is repeated until there is convergence of the proposed solutions, i.e. ideas proposed by all subgroups are basically the same, with the assumption that the

process of convergent development has resulted in an optimum (i.e. the best in a given situation) solution. Table 1 shows one scenario of such convergence, during which all three subgroups at stage 4 adopt and modify subgroup's B solution developed at stage 3, but during the final debate the modification C4 developed by subgroup C is accepted as the optimum solution (see also Fig. 5). Please note that the final outcome of this process, denoted as C4(B3(A2(B1))), is a composite of creative contributions of all three subgroups, adopted and modified at different stages of the process!

#### 4.2 Benefits of an e-learning implementation

The dynamics of subgroups switching between the ideas which have been proposed in an earlier round by other subgroups, or continuing with development of its own ideas, becomes quite complex (as seen in Fig. 5). Therefore, an online system helps in management of ideas, both within and among subgroups. Importantly, the entire process may be carried out only online, with subgroups maintaining their composition and having exclusive access to their virtual "workbenches" (subgroup profiles). While access to each workbench is limited to members of the appropriate subgroup, all participants have access to the general forum, to exchange ideas between the successive rounds. Each subgroup may choose to apply, at any stage of the process, more explicit and quantitative multi-criterial evaluation of ideas rather than intuitive assessment. Duration of particular stages (e.g. of idea generation and idea evaluation) and number of rounds may be set by the moderator, with added functionality of participant notification of approaching deadlines.



## Figure 4. The flowchart illustrating stepwise convergence between ideas generated by semi-independent subgroups (also known as "Discussion 66")

Source: Own elaboration

#### Table 1.

# A possible scenario of dynamic changes occuring during a session of the stepwise convergence method

one common topic explained to all participants					
dividing	subgroup A	subgroup B	subgroup C		
participants into subgroups					
1 <sup>st</sup> round	A develops idea A1	B develops idea B1	C develops idea C1		
	1 <sup>st</sup> forum	discussion	I		
2 <sup>nd</sup> round	ideas proposed by B are considered the best, adopted and modified	ideas proposed by A are considered the best, adopted and modified	ideas proposed by A are considered the best, adopted and modified		
	A1 -> A2(B1)	$B1 \to B2(A1)$	$C1 \rightarrow C2(A1)$		
	2 <sup>nd</sup> forun	n discussion			
3 <sup>rd</sup> round	A develops the same idea further A1 -> A2(B1) -> A3(A2(B1))	B reverts to its original idea B1, as modified by A, and develops it further B1 -> B2(A1) -> B3(A2(B1))	C develops the same idea further C1 -> C2(A1) -> C3(C2(A1))		
3 <sup>rd</sup> forum discussion					
4 <sup>th</sup> round 4 <sup>th</sup> forum discu	A adopts idea B3 and develops it further A1 -> A2(B1) -> A3(A2(B1)) -> A4(B3(A2(B1)))	B develops the same idea further B1 -> B2(A1) -> B3(A2(B1)) -> B4(B3(A2(B1))) ment that C4 (with mod	C adopts the latest idea developed by B and modifies it $C1 \rightarrow C2(A1) \rightarrow C3(C2(A1)) \rightarrow C4(B3(A2(B1)))$ ification) is better		
than A4 and B4 <b>Final desicion:</b> $C4(P2(A2(P1)))$ (with modification)					
<b>Final decision:</b> C4(B3(A2(B1))) (with modification)					

Source: Own elaboration





Source: Own elaboration

## CONCLUSIONS

Heuristic methods, if made available as e-learning tools, all acquire new levels of flexibility, which is an important component of the self-regulated learning approach to education (see Barak 2010) and of the environment conducive to innovativeness (Jasieński 2012a; Jasieński & Rzeźnik 2012). For example, they can be applied asynchronously, i.e. they allow users with conflicting schedules for participation in the same creative online session. The essence of many simple heuristic methods is that the results accumulate slowly and no one expects that the final result will appear after one formal session of creativity.

A well-designed online system will perform, more effectively than many human beings, the role of a stimulator, tactful moderator (e.g. preserving anonymity of participants, when needed; see Yong 2008) and patient collector of ideas. Members of the community (e.g. members of a laboratory or a research team, coworkers, students in the same study group etc.) are encouraged (and reminded by the system) to participate in the process, on a daily basis. Participation means both generating and submitting answers and judging them, while fulfilling recommendations with respect to anonymity and impartiality at the same time (Chang 2011).

Moreover, three major functionalities, namely data and idea visualization, social input, and enabling research would constitute major benefits of an e-learning implementation of heuristic methods (see also Batey 2012; Jasieński 2012b).

However, the main goals that remain are, of course, improving our creative fitness (Verberne 1997) and inventive ideation (Ross 2006), i.e. generation of new ideas.

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#### REFERENCES

- Barak, M., 2010: Motivating self-regulated learning in technology education. International Journal of Technology and Design Education, 20, 2010, pp. 381-401, ISSN: 0957-7572
- Barak, M., 2013: Impacts of learning inventive problem-solving principles: students' transition from systematic searching to heuristic problem solving. Instructional Science, 41, 2013, pp. 657-679, ISSN: 0020-4277
- Batey, M., 2012: The measurement of creativity: from definitional consensus to the introduction of a new heuristic framework. Creativity Research Journal, 24, 2012, pp. 55-65, ISSN: 1040-0419
- Butler, D. L., Kline, M. A., 1998: Good versus creative solutions: a comparison of brainstorming, hierarchical, and perspective-changing heuristics. Creativity Research Journal, 11, 1998, pp. 325-331, ISSN: 1040-0419.
- Chang, C. M., 2011: New organizational designs for promoting creativity: a case study of virtual teams with anonymity and structured interactions. Journal of Engineering and Technology Management, 28, 2011, pp. 268-282, ISSN: 0923-4748.
- Cook, S. H., Gordon, M. F., 2004: Teaching qualitative research: a metaphorical approach. Journal of Advanced Nursing, 47, 2004, pp. 649-655, ISSN: 0309-2402
- Cornelissen, J. P., 2004: What are we playing at? Theatre, organization, and the use of metaphor. Organization Studies, 25, 2004, pp. 705-726, ISSN: 0170-8406
- Cornelissen, J. P., 2005: Beyond *compare: metaphor in organization theory*. Academy of Management Review, 30, 2005, pp. 751-764, ISSN: 0363-7425

- Cornelissen, J. P., 2006: Making sense of theory construction: Metaphor and disciplined imagination. Organization Studies, 27, 2006, pp. 1579-1597, ISSN: 0170-8406.
- Denton, D. K., 1999: The Toolbox for the Mind. Finding and Implementing Creative Solutions in the Workplace. ASQ Quality Press, Milwaukee, WI 1999, ISBN: 0873894480
- Duran-Novoa, R., Leon-Rovira, N., Aguayo-Tellez, H., Said, D., 2011: Inventive problem solving based on dialectical negation, using evolutionary algorithms and TRIZ heuristics. Computers in Industry, 62, 2011, pp. 437-445, ISSN: 0166-3615
- Gordon, W.J.J., 1961: Synectics: The Development of Creative Capacity. New York: Collier Books, 1961.
- Greenberg, J., Baron, R.A., 2000: *Behavior in Organizations*. Prentice Hall, Upper Saddle River, 2000, ISBN: 0130850268
- Hey, J., Linsey, J., Agogino, A. M., Wood, K. L., 2008: Analogies and metaphors in creative design. International Journal of Engineering Education, 24, 2008, pp. 283-294, ISSN: 0949-149X
- Indurkhya, B., 2007: *Rationality and reasoning with metaphors*. New Ideas in Psychology, 25, 2007, pp. 16-36, ISSN: 0732-118X
- Jasieński, M., 2012a: Rules for constructing e-learning tools which foster independent, critical and innovative thinking. In: E. Smyrnova-Trybulska (Ed.), E-Learning for Societal Needs, pp. 75-94, University of Silesia, Katowice-Cieszyn. ISBN: 978-83-60071-59-5
- Jasieński, M., 2012b: Educating managers in Poland: more heuristics and more quality. In: J. Dietl, Z. Sapijaszka (Ed.), Economic Education under Changes in the Socioeconomic Environment, pp. 63-68, Educational Enterprise Foundation, Łódź, ISBN: 978-83-925649-5-9 [In Polish]
- Jasieński, M., Rzeźnik, M., 2012: Innovatics a new toolbox of skills for innovative production managers. In: R. Knosala (Ed.), Innovations in Management and Production Engineering, pp. 63-71, Polish Society for Production Management Publishers, Opole, ISBN: 978-83-930399-4-4
- Kaufmann, A., Fustier, M., Drevet, A., 1975: L'inventique Nouvelles Méthodes de Créativité. Wydawnictwa Naukowo-Techniczne, Warszawa, 1975 [In Polish].
- Linstone, H. A., Murray, T., 2002: *The Delphi Method. Techniques and Applications* available at http://is.njit.edu/pubs/delphibook (Accessed on July 20, 2013).
- Nęcka, E., 1994: *TRoP... Creative Problem Solving.* "Impuls" Publishers, Kraków, 1994, ISBN: 83-85543-48-1 [In Polish]

- Nęcka, E., 1998: *The Training of Creativity*. "Impuls" Publishers, Kraków, 1998. ISBN: 83-86994-69-X [In Polish].
- Nęcka, E., 2001: *The Psychology of Creativity*. Gdańskie Wydawnictwo Psychologiczne, Gdańsk, 2001. ISBN 83-87957-50-X [In Polish].
- Oswick, C., Keenoy, T., Grant, D., 2002: *Metaphor and analogical reasoning in organization theory: Beyond orthodoxy*. Academy of Management Review, 27, 2002, pp. 294-303. ISSN: 0363-7425.
- Proctor, T., 2002: Creative Problem Solving for Managers. Gdańskie Wydawnictwo Psychologiczne, Gdańsk. ISBN: 83-87957-80-1 [In Polish]
- Ross, V. E., 2006: A model of inventive ideation. Thinking Skills and Creativity, 1, 2006, pp. 120-129: ISSN: 1871-1871
- Verberne, T., 1997: *Creative fitness*. Training & Development, 51, 1997, pp. 68-71, ISSN: 1055-9760
- Vessey, W. B., Mumford, M. D., 2012: Heuristics as a basis for assessing creative potential: Measures, methods, and contingencies. Creativity Research Journal, 24, 2012, pp. 41-54, ISSN: 1040-0419
- Yong, J. M., 2008: Enhancing the privacy of e-learning systems with alias and anonymity. Computer Supported Cooperative Work in Design IV, pp. 534-544, ISBN: 978-3-540-92718-1
# DISTANCE OR PROXIMAL LEARNING: MEDIUM MATTERS

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**Abstract:** In distance education, communication technology supports an extant curriculum based on the text-book: a prior technology. Whilst we presume that language is at the heart of education, we rely on technology. But the word 'technology' is much misused and we lack any scientific understanding of our capacity for technology. As a consequence we are unable to challenge tradition. An answer to the question concerning technology that is consistent with the second law and evolutionary principles is outlined. The Turing machine, the conceptual basis of the new medium, defines its relationship to thought. The benefits of displacing the unsociable frigid flatland of the school-book by assistive Turing media are introduced.

**Keywords:** learning media, technicity, Turing machine, primary education, teaching method.

#### **INTRODUCTION**

In the nineteen twenties, my father gained his first degree by attending evening class and using correspondence courses. Modern e-learning has replaced print, postman and phone by a plethora of electronic origination and communication media. Yet, the foundation of education remains unchanged. We constantly refer to 'technology' but the meaning of the word is obscure: the term ICT (information and communication technology) might equally apply to pen and paper and e-learning to the use of wireless, television and telephone. Despite the fact that we deem language to be our highest cognitive capability, it seems more to obfusticate than illuminate thought in this realm. Moreover, despite the fact that our species is technology dependent, we have no idea how we came to have the capacity for technology. The first step is to give this capability a name: I have borrowed the term 'technicity' from the philosophy of Heidegger. The first chapter of this paper will outline a notion of the evolution of technicity that is consistent with evolutionary principles, hominine evolution, and, critically, with the second law of thermodynamics. With this foundation in place, we are in a position to consider, in the second chapter, the new medium we are using at its conceptual level: the Turing machine. By this, we replace our terminological menagerie with a single conceptual term: Turing medium. With a sound understanding of the relationship of technology (now well defined) to the mind, we are in a position, in the third chapter, critically to examine the modes of education and their associated media. This analysis suggests that, at an institutional level, the current approach to learning is not efficacious and in the primary phase abusive of children's minds. Given the power of the tertiary phase of education, is it possible that the distance learning community, who needs must use Turing media, may begin to catalyse the process of change?

# 1. THE QUESTION CONCERNING TECHNOLOGY

We laud language and ignore the technology that makes possible our world and lifestyle. The absence of any scientific explanation of the human capacity for technology leaves a chapter of psychology unwritten. Here I provide notes on a proposition that will form the basis for this missing chapter. The Mind's Lie

We see a world coloured in a multitude of tints and shades. I was not so long ago that we came to realise that our brain paints the world in false colour. The visible spectrum, the rainbow, whatever the popular song might say, contains neither pink nor purple. Thanks to the work of David Hubel (1995) and colleagues, we now know that since the evolution of bony fishes some 500,000,000 years ago, all vertebrates have a neural mechanism that paints the world using a three dimensional colour space delimited by the opponent pairs: red/green, blue/yellow, and black/white. Only since science revealed the electromagnetic spectrum can we be aware that there are no pink photons and that pink and purple are constructs of our mind. But, our minds' lies go deeper than this.

#### 1.1.1 When is a Square not a Square?

Consider the two views in figure 1.





Figure 1a, 1b. A view through a window; 1b is rotated by a one eighth turn

One item changes its name as the scene is rotated. The diamond motif becomes square. Geometrically they are the same. Why does our brain think they are different objects and name them differently?

# **1.2 Nobody Expects the 2<sup>nd</sup> Law**

Figure 1 also illustrates a truth about technology: It is an order of magnitude simpler than nature. This poses a problem. A fundamental law of nature first described as the second law of thermodynamics, states that it is not possible to progress from the complex to the simple. How can a complex organism create simple technology? How do humans conceive a perfect square?

#### 1.2.1 It's in the Genes

The complexity issue may be solved at a genetic level. The information in DNA which determines the phenotype is simple. The mechanisms in the organism are an expression of this information; e.g. the Hubel colour-space space mechanism.

#### **1.2.2 Hubel Information**

The information that interfaces the organism to the environment, from which the organism constructs false but adaptive percepts, I call Hubel information. Visual Hubel information includes line length and angle, and direction of motion. Here, with colour, is the information necessary to devise the game of snooker or construct a telescope. The line/angle information is the source of the ideal square. Thus, in the brain there is a source of simplicity; provided the mind has access to it.

# **1.3 The Technicity Proposition**

I have proposed that in the human, and only in the human, neurones from working memory interact with the sources of Hubel information (Ó Dúill 2012). This provides cognition a source of simplicity with which to construct objects impossible in nature. Once constructed, they are powerful Papertian objects (Papert & Harel 1991).

#### 1.3.1 Naïve and Scientific Thought

Papertian objects are built from raw Hubel information. By the 2<sup>nd</sup> law, their simplicity gives them greater cognitive power. Their soundness is tested against the laws of physics, understanding of which they make possible. Thus, we were able to propose two opposing geometric representations of earth in the heavens: geocentric (consistent with perception) and heliocentric (physically correct). Resolution came only when technology enhanced our visual acuity. However, because language is linked directly to perception and only indirectly to technicity, there is ongoing conflict between naivety and science.

#### **1.3.2 Development**

Technicity, an evolved adaptation, comes on stream after language has developed. Its first appearance is in the scribbles of infancy. Its genesis may traced by the increased capability of children in primary education to express something in mind by drawing. The curriculum reflects the technicity adaptation in its core of literacy and numeracy.

# 2. ALAN TURING'S MACHINE

Turing (1950) considered the relationship of an electronic computer to the mind. His original (1937) paper, which he cites, described a computer in terms of someone working in a notebook. Reading symbols from the page, pencil/eraser in hand, the person scans the text with an objective in mind. Depending on the state of mind, symbols may be erased, written, or the reader may move on or back; which may lead to a change in state of mind. It is a simple and powerful model of learning from text.

#### 2.1 Turing Media

We may now replace the plethora of technology-derived terms applied to our new educational medium with the single cognitive concept of Turing machine. Note: like the text it enhances, it is a powerful Papertian object.

# 3. MODES OF EDUCATION

With this foundation sketched in, we may now consider education itself. Three learning modes are used in teaching: talk, text, and Turing.

#### 3.1 Talk

This is the verbal mode of Socratic discourse. It is open to any species that possesses language (which implies that it was used by our Neanderthal cousins). Its constraints come from linguistic diversity and the need for accurate recall. Its advantage is that no medium is required: we carry around with us the means of transmission and reception. Its disadvantage is the limitation imposed by personal memory capacity. The fundamental cognitive constraint is that language is isolated from technicity. Thus, in the absence of a supportive Paperian object learning is formulaic. A nice example is verbal learning of number facts and times-tables.

#### 3.2 Text

The foundation of traditional learning, the text-book is prose with illustrations. Language, shorn of its prosody, is encrypted in sequential symbols. Line is used both for these and the accompanying figures. Text, a product of technicity, is a Papertian object. It is permanent and open to public inspection. Thus, it circumvents the impermanence and memory demands of the spoken word. Based on drawing, it facilitates non-linguistic expression, e.g. geometric forms and numerals. In printed and now electronic form, the knowledge and thought encoded in text is widely accessible.

# 3.2.1 Frigid Flatland

The language diversity problem aside, text has significant issues. The information is not just preserved memory, it is a two dimensional frozen representation. This means that before the information may be retrieved, the reader must have learned to decrypt and animate. To demonstrate successful reanimation the learner must also be able to encrypt. Primary school is dominated by this process: the core skills of reading, writing, and arithmetic. In this process the medium offers no assistance. The only help a child receives is the occasional intervention of the teacher and much delayed red-pen feedback.

#### 3.3 Turing

This medium, just over 65 years old, entered primary education as a teaching medium 30 years ago. Its capabilities caused consternation. Its use was proscribed for literacy and numeracy, where traditional method was prescribed, e.g. in England (DfES 2006). The problem was twofold: the capabilities of the medium in relation to teacher expertise; and the issue of assessment.

#### 3.3.1 Action

The Turing medium is multimedia: not only may it present frigid graphic forms, as in this paper, but is capable of presenting movies with sound. However, the greatest concern in primary education, was the capability to animate text; notably mathematical notation. There was a presumption that, for instance, using a calculator before children had orally learned number facts and could do mental arithmetic was intellectually unsound. This implies that the 'talk' mode has primacy.

#### 3.3.2 Assessment

It should be immediately obvious that this presumption is a function of the means of assessment. Where children are tested by verbal response, orally or on paper, memory and mastery of text (and the steps towards mastery that are a function of traditional method) will in large part measure success. If a child has learned using a calculator, these skills will be less developed and success deemed lower. The new medium is incompatible with traditional teaching method.

#### 3.3.3 Assistance

When, however, the learner is considered, the Turing medium offers a great advantage: it has the capacity to assist. The young child is no longer faced with the flatland of the book with its frigid symbols demanding as yet undeveloped decrypting and animation skills. The same graphic forms now may be active and show how they work. It is possible to construct a curriculum and to devise teaching method that makes use of this assistive capability. With help from the medium and feedback that is immediate, the role of the teacher changes and the red pen may be retired.

# 4. ISSUES FOR TRANSITION

There is no doubt that, in the longer term, transition to Turing teaching must occur. The road block is no longer the availability of the medium. It is an academic/political milieu that seeks to conserve its own traditions and capabilities. The Cambridge Primary Review (Alexander 2010) assigned primacy to language and failed to see 'the computer' as a new medium. Gove, the current English Minister for Education, is imposing a primary curriculum that denies the existence of a new medium (DfE 2013). The language presumption is now dethroned by technicity. In this context, it is necessary to consider the efficacy of traditional method and matters of child development.

#### 4.1 Arithmetic Method

Every time you buy something in a shop a calculator computes your bill (and feeds back information to stock control). Yet, in school we consider skill in mental arithmetic to be a measure of intellect. How good is traditional teaching method? Recall: children begin with ten beads on a counting frame, Dienes apparatus, and use hundred squares. It is presumed that counting and working in groups of ten aids understanding, a preparation for carrying later. Children concurrently learn number words and facts; and rote-learn their times tables.

#### 4.1.1 Counting and Computing

When we count, we group objects into bundles of ten and begin the count again at one. The language of number works differently: starting from nothing we count up to nine and then shift register on the decade. In English, we count to nine-teen and then increment the decade register on twenty, cf. a car odometer. The same is true of other languages. Language, as we saw with the diamond/square effect, is a window onto the working of the mind. Number language is congruent with our numeral system. Physical counting is not. To what extent does current method inhibit the development of computation in learners? If children were enabled to explore the numeral system with the assistance of a Turing machine, would their understanding of number be better or worse?

# 4.1.2 Computing and Constructing

It is a common complaint that children leaving school are unable to apply their knowledge in a real world setting. This is particularly so in mathematics. I have recently had the privilege of applying the Ilieva approach to using LEGO educationally in primary school (Ilieva 2010). One notable difficulty was an inability to apply the number facts that tripped of the children's tongues to construction. LEGO has bricks of length 1, 2, 3, 4, 6, 8, etc., there is no 5-brick. A gap of five studs posed a major problem. The number fact "2 plus 3 make 5" did not to come to mind. Was their number knowledge locked into the verbal domain and unavailable to constructional thought?

#### 4.1.3 Using Graphic Information

We are used to examination candidates misreading the question. As a result of exploration in school, I have devised a small test of the ability to transform two dimensional graphic information into its three dimensional counterpart. Figure 2 shows two views of a small, simple LEGO house with no back. The subjects are supplied with exactly the bricks required to construct the house and five helpful hints,



Figure 2. The two pictures of the house and the incorrect construction (centre)

None of the children in the primary school were able to construct the model from this information. They needed a ready-built three-dimensional model to replicate. Adults varied in their capability. One notable outcome was produced by a university education professor and colleagues: their house looked correct but the bricks were not bonded on the corner (figure 2 centre). Yet, all the information required is in plain view and everyday observation of houses ought to have informed their strategy. The task is a simple application of number to shape and space. Not only does talk and text lock knowledge into the language domain but the frigid flatland of the book inhibits three dimensional thinking.

#### 4.2 Mastering the Medium

Whilst children are systematically taught mastery of text as a medium, mastery of the Turing medium is not. In Bulgaria, Ilieva (a primary school teacher) devised a curriculum to teach mastery. Approved by the government as an elective subject, it is current (Ilieva and Doyle 2013). She found that children, systematically taught all the capabilities of the medium through activities normal for the child's age using a project oriented approach, produced work of a higher quality that that in their

exercise books. In the Turing medium, means of expression unavailable in the flatland of pencil and paper were open to them, offering a far richer learning environment.

#### 4.2.1 No Application

Exercise of this mastery throughout the curriculum was systemically impossible. Prescribed teaching materials were all books and assessment was based on performance with them, cf. the PISA tests. The use of Turing media remain within the audiovisual aid tradition. This will be so as long as education is controlled by the academic/political milieu who are wedded to traditional media and fearful that change will reduce the intellectual status of the skills by which they define their success.

#### 4.3 Matters Neurological

The primary school years are critical in a child's development. The connections made by prefrontal cortex, which provides the executive function for the perception action cycle and is the site of working memory, are made in this phase of education (Fuster 2008). Affective maturity is complete by its end and the cognitive largely mature. Experience contributes significantly to sculpting the connective matrix. Thus, teaching method and medium mastery will have a major effect on the outcome.

#### 4.3.1 Benefits and disbenefits

With two technological media on offer, text and Turing, we may question their relative benefits for affective and cognitive development. Success in surmounting the challenge of decrypting text unaided will be motivating. Conversely, failure will have negative affective consequences. But school is not a competitive sport. It aspires to maximise individual potential. It follows that the disbenefits, emotional and cognitive, of an obstructive medium are incompatible with this aim.

# CONCLUSION

This paper has introduced two unfamiliar ideas. However uncomfortable the technicity proposition might be, it is consistent with the principles of evolution and fundamental physical laws, however unexpected these are in behavioural science. The Turing medium notion provides a cognitive focus in a realm that has been technology dominated. Combined, these enable us to view education through the lens of the 'technology' deployed. Traditional text is seen to be obstructive of learning in the primary school years, engendering failure. The Turing media is mature, available and assistive. Not to begin the transition of teaching method to this medium is tantamount to building in failure, effectively condoning mental and emotional abuse. Primary education professionals are powerless to engender such change: they are subject to the academic/political milieu. They are trained to feed children an endless stream of symbols, treating them as Turing machines. Surely it is

time to change their role and for them to teach with the Turing medium to hand? How to change the view of the academic/political milieu, where Govery\* presides, there's the rub.

#### REFERENCES

- Alexander, R., (ed.), 2010: Children, their World, their Education, London, Routlege
- DfES, 2006: *Primary Strategy for literacy and mathematics*. London, Department for Education and Skills
- DfE, 2013: Draft national curriculum programmes of study, available at https://www.education.gov.uk/schools/teachingandlearning/curriculum/national curriculum2014/b00220600/draft-national-curriculum-programmes-of-study (accessed 10 July 2013)
- Fuster, J. M., 2008: The Prefrontal Cortex, 4th edition. London, Academic Press
- Hubel, D. H. 1995: *Eye, Brain, and Vision*, available at http://hubel.med.harvard.edu/ (accessed 17 July 2013)
- Ilieva, V., 2010: LEGO and LOGO in the Primary School a simple way to learn through creation. In: Clayson, E.J., Kalaš, I, (eds) Proceedings of Constructionism 2010 – 12th European Logo Conference. Bratislava, Faculty of Mathematics, Physics and Informatics Comenius University.
- Ilieva, V., Doyle, M., 2013: ICT in the Bulgarian Primary School. In: Reynolds, N., Webb, M. (eds.) Proceedings of WCCE 2013, 10th World Conference on Computers in Education, 2, pp. 1-8. Torun, Nicolas Copernicus University Press
- Ó Dúill, M.: *The Technicity Thesis: A constructionist proposition*, available at http://etl.ppp.uoa.gr/constructionism2012dailly/constructionism2012\_proceedin gs.zip (accessed 19 August 2012)
- Papert, S., Harel, I., 1991: Situating Constructionism, available at http://www.papert.org/articles/SituatingConstructionism.html (accessed 19 August 2013).
- Turing, A.M. 1950: *Computing machinery and intelligence*, available at http://mind.oxfordjournals.org/content/LIX/236/433 (accessed 19 August 2013)

\* Note: the term "Govery," which implies a blind faith in traditional values when change is imminent is named after the current English Minister of Education, Michael Gove.

# EVALUATION OF THE STUDENTS KNOWLEDGE WITH USING RAPID E-LEARNING TOOLS

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**Abstract:** The process of student knowledge evaluation is one of the key tasks of every college and university professor. Both in traditional learning and in distance learning, software that facilitates and automates this process is used more and more often. With the development of e-learning, the popularity of methodologies and tools for quick creation of materials, known as rapid e-learning, has been increasing. This article presents the characteristics of this group of tools and shows, using selected examples, their usefulness in the process of evaluation of student knowledge.

**Keywords:** rapid e-learning, evaluation of knowledge, rapid e-learning tools, tests and activity creation tools, Articulate Studio 2009

#### **INTRODUCTION**

Evaluation of student knowledge is one of the key duties of college and university professors. This is a time-consuming and repeatable process as a large part of examination and test materials has to be prepared from scratch at least once a year. This can be facilitated by various information technology tools that automate the editing work. Preparation of resources in such software must be fairly simple so that every teacher can do it by himself. Lack of time and lack of skills needed to use special software are the most common reasons for decisions not to prepare teaching materials in electronic versions (Ren-Kurc, Kowalewski, Roszak, Kołodziejczak 2012: 209-211).

In the authors' opinion, attention should be paid to applications for rapid e-learning as, thanks to their functionality and ease of use, they can become a useful tool for every college or university professors.

#### 1. THE ROLE OF STUDENT KNOWLEDGE EVALUATION

Testing and evaluation of the progress achieved by students are very important both for the teachers, who can see the results of their work and can make corrections, and for the students, who can see the outcomes of their efforts, which motivates them to keep working hard. One of the tenets of the Polish higher education reform of 2011 is that higher education institutions must document the achievement of the assumed educational results (Banachowski, Nowacki 2012: 59-60); consequently, evaluation of student knowledge is very important for schools, too.

Evaluation of student knowledge comprises:

- observation, analysis, and evaluation of learning progress achieved;
- observation and evaluation of the activities related to self-teaching of individual students as well as entire learning groups (exercise groups, lecture groups, etc.);
- feedback from students about educational and development achievements (Bednarek, Lubina 2008: 176).

Verification of teaching effectiveness consist in comparing the students' achievements (knowledge and skills) with the assumed teaching objectives and should be conducted throughout the entire course, academic year or semester.

#### 1.1 Evaluation of student knowledge in distance learning

Evaluation of student knowledge in distance learning plays a special role and is particularly important in the learning process due to the limited nature of contacts between the teachers and the students. New technologies and fast development of new software enable using various methods of evaluation and preparing various diagnostic tools (Heba, Smyrnova-Trybulska 2011: 76-80). Besides the traditional and broadly used test method, other methods are used, such as educational games, quizzes, crosswords and simulations.

The electronic form of the evaluation of the learning process has many *advantages* including:

- a broader scope of knowledge can be tested;
- a larger group of students can be covered by the test process at the same time;
- subjective evaluation is eliminated thanks to the use of a point system;

- the examination sets are individualized, which results in a sense of fair evaluation;
- the results of the evaluation can be obtained quickly, often immediately after the test has been taken (Roszak, Kołodziejczak, Kowalewski, Ren-Kurc 2013: 40);
- the forms of evaluation of student skills are interactive;
- it is possible to easily analyze the outcomes of the learning process thanks to tools, such as those integrated with the e-learning portals;
- it is possible to quickly transform the contents being taught into review material with a self-evaluation component (Roszak, Kołodziejczak, Ren-Kurc, Kowalewski, Bręborowicz 2013: 41-42);
- systematic evaluation is possible without putting an excessive burden on the teacher (this does not include the evaluation process preparation stage).

The *disadvantages* of this evaluation method include:

- the process of preparation of the evaluation using the distance-learning methods is time-consuming;
- the teachers need to have appropriate ICT competences (Ren-Kurc, Kowalewski, Roszak, Kołodziejczak 2012: 201-212);
- the school must have appropriate computer labs or computer equipment with Internet access for the students;
- students can get help from others during examinations taken away from school;
- students can guess the answers (Ren-Kurc, Roszak 2011: 255-257);
- students cannot discuss their doubts or concerns right away, e.g. when they are solving a problem or taking a test;
- the possibility to provide feedback, to include substantiation of the grade, is limited.

The more and more frequent use of e-learning portals in the process of evaluation of student knowledge leads to more effective use of the advantages of the electronic evaluation methods.

This is because educational portals offer various tools for designing problems and tests using multimedia elements. They also provide interactive forms of skill testing and tools for creating extensive descriptive evaluations, as well as simple feedback that gives guidance to students as to their further actions. They make it possible for students to see the progress they have achieved and to monitor it in an ongoing manner. Also, they support team work and exchange of experiences between participants of the learning process. Access to all forms of the students' activity on the educational portal (logs, notes, comments, forums, etc.) enables the teacher to fully monitor their activity and progress and use this information for performing their comprehensive evaluation. The technical possibilities of testing, evaluation and give feedback (e.g. using e-learning portals) give teachers the opportunity to control the process of teaching and learning.

# 2. RAPID E-LEARNING

The term *rapid e-learning* refers mostly to quick and optimized methods of preparation of e-learning courses (Kompendium e-Edukacji 2013). The on-line courses elaborated using this technology have the following characteristics:

- their budgets and required preparation time are limited;
- the teams responsible for their preparation are small and most often comprise an expert in a specific field and, possibly, a lecturer, a graphic artist, and a LMS portal expert;
- the courses use ready-made graphics and templates available in the edition tool that was used;
- the structure of the contents is simple and the navigation is intuitive;
- preparation of the course does not require programming skills and integration with an LMS portal is easy to perform.

The quick development of e-learning in the 1990's caused a large demand for training courses and made the organizers aware of the complexity of the process of their creation. Because of the technological problems that occurred and the high costs of creation of courses from scratch, the existing resources were used, e.g. multimedia presentations (Penkowska 2007, Rusek 2011).

After 2000, a series of rapid learning tools were proposed on the market and became popular because of their simplicity and the feeling that anyone could build an elearning course from a simple PowerPoint presentation (Kołodziejczak 2011). As has been mentioned, the quick development of e-learning had also some economic foundations. Preparation of a traditional course usually takes between ten and twenty months. In contrast the aim of rapid e-learning is to build and roll out content modules within weeks. For example, while one hour of standard e-learning can take 73 to 220 hours to develop, a PowerPoint to e-learning conversion can be estimated to take an average of 33 hours to develop (Time to Develop One Hour of Training, http://www.astd.org/Publications/Newsletters/Learning-Circuits/ Learning-Circuits-Archives/2009/08/Time-to-Develop-One-Hour-of-Training).

However, courses prepared on the basis of presentations had a fundamental disadvantage: they were limited to passive presentation of knowledge and involved no interaction with students. Rapid e-learning was criticized for breaking the "learning by doing" rule. This is why the most recent tools for course development

are equipped with mechanisms for creating interactive elements, such as tests, quizzes, simulations, etc. Currently, due to the financial situation of universities, rapid e-learning is an important trend in education (Gajewski 2011).

### 3. CHARACTERISTICS OF RAPID E-LEARNING TOOLS

Now that rapid learning development has become an integral part of the authoring practice worldwide, some authors and consulting companies focus on how to reach the optimal compromise between the economic need for rapid learning and the pedagogical objective of a good instructional design (Rapid E-Learning, http://www.kineo.com/rapid-elearning/rapid-e-learning.html).

In the opinion of the authors of this article, tools for developing the educational content in rapid e-learning should have the following characteristics:

- ease of design of contents and their future updates;
- creation of materials mostly on the basis of ready-made templates;
- possibility to simply link existing contents and to insert graphics and multimedia;
- possibility to publish courses in formats complying with the SCORM/AICC standard;
- possibility to handle (save/read) many file formats;
- possibility to connect educational contents with different forms of student activity;
- possibility to systematize and structure knowledge without reducing the attractiveness of the form;
- a simple interface and an intuitive navigation;
- possibility to add tips, feedback, and summaries;
- no need to use programming languages to create materials.

The above list of requirements appears to be self-evident but is not so easy to achieve because, on the one hand, we expect the tools to be simple to work with and intuitive and, on the other hand, we want them to provide the author with a number of functions related to content building and student activity. There are many applications with different functionalities in the market. Most of them are authoring tools that include rapid learning as a feature. These include Articulate Storyline, Articulate Studio, ActivePresenter, Adobe Captivate, Dokeos, and LCDS.

Each of the aforementioned programs enables preparing tests and other student activities. Thus, they can be a useful tool for evaluation of students knowledge.

# 4. EXAMPLES OF RAPID E-LEARNING TOOLS

This chapter contains a review of selected applications for building materials for revising and testing student knowledge using rapid e-learning tools. The choice of the software is subjective and based on the experiences of the authors of the article gained during the 9 years of their work in the field of academic distance learning at three universities in Poznań.

#### 4.1 Learning Content Development System

Learning Content Development System (http://www.microsoft.com/learning/en/ us/lcds-tool.aspx) is an editor of e-learning materials that, in the opinion of the authors of this article, deserves particular attention. Three of its functionalities are unique compared to other freeware software: a large number of templates for creating educational contents, a broad base of interactive elements, and an integrated tool for creating test preparation books based on the existing course edition.

The LCDS editor stands out from the many similar tools thanks to the large number (24) of different templates for creating educational content (see Figure 1), to include 14 for systematizing and checking student knowledge. These are:

- 1. Interact (Adventure Activity\*, Drag and Drop, Interactive Job Aid, Slider, Sequence Activity),
- 2. Watch (Animation\*, Demonstration\*, Media with Key Points, Click Table Animation),
- 3. Play (Sort Game\*, Tile Game\*, Card Flip\*), and
- 4. Try (Simulation, Lab Scenario/Offline).



Figure 1. Adventure Activity in LCDS Source: Own elaboration

The templates marked with the asterisk (\*) can be used for building review materials based on the course materials.

Their arrangement according to the student activity criterion greatly facilitates their selection in accordance with the principles of development of materials intended for distance learning. Materials prepared in the LCDS editor can be saved in the publication version that is ready for posting on an LMS portal or outside of distance learning portals – in resources stored on WWW servers. The materials can be exported from the editor in the following formats: RTF files (for local reading or for printing), SCORM 1.2 packets, single SCO packets for aggregation in different SCORM units, Media Map (a CSV file), term indices, and Topic Thumbnails (a kind of topic lists).

Self-tests taking into account different context of knowledge being taught are very important to the learning process. The LCDS editor has a functionality that is unique in educational content authoring tools, namely a special module named "LCDS Learning Snack" for preparing test preparation modules based on the existing course edition. Review materials and self-tests can be prepared in this editor in two ways: by choosing the key nodes from the course in the LCDS or by building the review content based on a course from another tool (Roszak, Kołodziejczak, Ren-Kurc, Kowalewski, Bręborowicz 2013).

#### 4.2 Articulate Studio 2009

Articulate Studio 2009 (http://www.articulate.com/products/studio.php) is a package of educational materials authoring software based on Power Point which comprises:

- Articulate Quizmaker a tool for preparation of tests;
- Articulate Engage a tool for preparation of interactive slide shows;
- Articulate Presenter the main tool that combines elements from the other software of the Articulate Studio package;
- Video Encoder a tool for converting films saved in popular video formats (avi, mpeg, etc.) into Flash files.

For many years, Articulate Studio 2009 has been one of the leading rapid e-learning tools. After installation, Articulate Studio 2009 becomes fully integrated with PowerPoint, with the *Articulate* tab appearing on the Power Point ribbon. Two programs from this package, namely Articulate Quizmaker and Articulate Engage, are particularly useful in the process of evaluation of student knowledge.

Articulate Quizmaker is the part of Articulate Studio 2009 with an intuitive and easy to use interface (see Figure 2).

	Quiz1	- Articulate Quizmaker '09		-	ΞX	
Home Help					0	
Graded Survey Question Question Question	Edit Question	t Include: All - Randomize @ Lock Question - Group	Player Quiz Spelling Templates Properties	Preview Publish		
Insert	Edit Results	Group	Quiz	Publish		
Question Points						
1 No questions. Add the first <u>araded</u> or <u>survey</u> question.						

#### Figure 2. Quizmaker window for graded quiz

#### Source: Own elaboration

The program enables creating tests and surveys. In the case of tests, each answer is assigned a certain value and is evaluated. Survey questions are not assigned any values and the answers given by students are not evaluated. This application offers various types of test questions, starting from single- and multiple-choice questions, true/false questions, questions where the answers are to be matched (Matching Drag and Drop, Matching Drop Down, Word Bank), and questions where the answers must be put in a proper order (Sequence Drag and Drop), through tests with questions that require calculation and questions with active places (Hot Spot). In total, there are 11 different types of interfaces for developing test questions (Shank, Bircher 2009: 313-334).



Figure 3. Matching Drop Down question

Source: Own elaboration

Survey questions are prepared based on 9 available templates: Likert scale questions, selection of one or many options, providing short or long answers, arranging statements in a certain order, and providing answers in the form of numbers (see Figure 4).

New Survey Question						x	
New Survey Question Select the type of survey questi	ion you want to create.					a	
Likert Scale							
Pick One	service provider.	1	2	2	4	5	
Pick Many	Number and variety of channels Access to exclusive HD content	©	0	0	• •	© ●	
Which Word	Internet upload and download speeds Unlimited calling to United States and Canada Integrated DVR at no additional charge	0	0	0	O Agree		
Short Answer					Ð		
Essay							
Ranking Drag and Drop	Likert Scale						
Ranking Drop-down	Likert Scale is a survey question that allows response that best represents his or her op	the user inion rela	to e tive	to a	se th seri	ie ies of	
How Many statements. There is a maximum of 10 statements for each Likert Scale question.							
Learn more about creating	a survey question		Ж			Cancel	

Figure 4. New Survey Question dialog box

#### Source: Own elaboration

The software enables importing ready-made questions, in the form of a file, a group of questions, or a single question, from other quizzes prepared in the Quizmaker software. The application enables:

- grouping questions by topic;
- defining the random order and the number of question in a topic-related group;
- branching of the test so that students get different questions depending on their answers to the previous question;
- adding a time limit for completion of the test.

Once the test is finished, it can be published in the Flash format and made available locally in a default browser through a LMS portal or the Articulate Online website. Moreover, the test can be saved on a CD or as a Word document.

The software enables adding feedback comments to each question in a test or a survey, returns the final results of tests in the form of summaries, and enables reviewing the answers given by students (see Figure 5, 6).



Figure 5. Pass result slide

Source: Own elaboration

uestion 1 of 4 🔹	- INCORRECT -	Point Value:
Match statistical test to the pro	oblem:	
Are data normally distribute	d ? Shapiro-Wil	
Are variances equal ?	Levene's tes - Fish	ner-Snedecor test
Is there association between categories of one factor and categories of the other facto population ?	the I the Fisher-Sned Chi	i-squared test
What statistical test can we u compare the distribution of in two different groups ?	use to ordinal data Mann-Whit	

Figure 6. Quiz review with feedback comments

#### Source: Own elaboration

Articulate Studio also includes Articulate Engage - a tool for creating interactive elements for e-learning courses. The software provides 10 different forms of student activities that can be used in self-tests or review materials (see Figure 7). In the

opinion of the authors, the particularly useful activities are (Shank, Bircher 2009: 610-624):

- FAQ a collection of clickable questions; viewers click a question to display the answer;
- Process describe the steps or phases of a linear procedure or process;
- Tabs describe a set of items that are related in some way, such as a series of concepts, members in a group or differences among objects;
- Timeline provides a visual way for viewers to move through a timeline of chronological events;
- Glossary a collection of clickable terms displayed alphabetically.

tatistics - repetition in the FAQ form
Search
statistics - repetition for students of medicine
Population, representative sample
Measurement scales
Nominal scale - differentiates between items or subjects based only on their names or (meta-)categories and other qualitative classifications they belong to.
Examples: gender, nationality, ethnicity, language, genre, style, biological species
Ordinal scale - allows for rank order by which data can be sorted, but still does not allow for relative degree of difference between them.
Examples: educational stage; military ranks; height: short, average, tall; weight in terms of BMI; Apgar scale, health: healthy, sick
Normal distribution
Probability
Correlation analysis
Statistical tests for comparing

Figure 7. Revision material in the FAQs form

#### Source: Own elaboration

Even though Articulate Studio 2009 is commercial software, it is very popular thanks to the fact that it combines extensive functionalities in the area of content creation with a simple interface and an easy process of publication both in local resources and on LMS portals.

# CONCLUSION

The development of information technologies enables partial automation and simplification of the process of testing and evaluating the progress achieved by students. However, it also requires teachers to improve their ICT skills. This is why, in the opinion of the authors of this article, of note are the opportunities provided in this area by rapid e-learning tools. A simple, intuitive software interface, numerous content templates, support of multimedia, and a simple process of course publication are the basic features of such software.

Information on the key criteria for selection of rapid e-learning authoring tools and a comparison of their capabilities can be found at http://www.kineo.com/rapid-elearning/five-key-considerations.html.

#### REFERENCES

- Articulate Studio '09, available at http://www.articulate.com/products/ studio.php, (accessed on 27 July 2013)
- Banachowski, L., Nowacki, J., 2012: Improving process of teaching students by means of methods and tools of knowledge management and e-learning. EduAction. Electronical Education Magazine, Vol. 4 No. 2, 2012, pp.49-60. ISSN 2081-870X [In Polish]
- Bednarek, J., Lubina, E., 2008: Distance learning. Fundamentals of didactics. Polish Scientific Publishers PWN, Warsaw, 2008, pp.176, ISBN: 978-83-01-15471-4 [In Polish]
- Create online courses and Silverlight Learning Snacks with LCDS, Available at http://www.microsoft.com/learning/en/us/lcds-tool.aspx, (accessed on 20 July 2013)
- Gajewski, R.R., 2011: Social software and streaming transmissions in creating open educational resources. Methodology and evaluation of e-learning, Sc. ed.: Ochnio, L., Orłowski, A., Publishing House of SGGW, Warsaw, 2011, pp.43-45, ISBN: 978-83-7583-276-1 [In Polish]
- Heba, A., Smyrnova-Trybulska, E., 2011: Proprietary theoretical and methodological computer-oriented system for the development of mathematical competence of students. Use of E-learning in the Developing of the Key Competence, Sc. ed.: Smyrnova-Trybulska, E., Studio Noa, Katowice-Cieszyn, 2011, pp.65-93, ISBN: 978-83-60071-39-7
- Kołodziejczak, B., 2011: *PowerPoint as a tool for e-learning*. E-mentor, No. 5 (42), 2011, pp.51-55, ISSN: 1731-6758 [In Polish]
- Kołodziejczak, B., Roszak, M., Rapid e-learning in biostatistics, available at http://www.stat.gov.pl/pts/kongres2012/dok/streszczenia\_referatow.pdf, (accessed on 1 July 2013)
- Compendium of e-Education, available at http://www.czn.uj.edu.pl/ kompendium/?q=node/512, (accessed on 20 July 2013) [In Polish]
- Penkowska, G., 2007: Polish e-learning from the experts' point of view part 2. E-mentor, No. 4 (21), 2007, pp.34-38. ISSN 1731-6758 [In Polish]

- Rapid E-Learning, Available at http://www.kineo.com/rapid-elearning/rapid-elearning. html, (accessed on 19 July 2013)
- Ren-Kurc, A., Kowalewski, W., Roszak, M., Kołodziejczak, B., 2012: Building Digital Content for E-Learning. Information and Communication Technologies (ICT) Competence. E-Learning for Societal Needs, Sc. ed.: Smyrnova-Trybulska, E., Studio Noa, Katowice-Cieszyn, 2012, pp.201-212, ISBNa; 978-83-60071-59-5
- Ren-Kurc, A., Roszak, M., 2011: Evaluation of the teaching process. The organization of test exams and survey. Information Technology in The Teacher's Workshop, The new educational challenges, Sc. ed.: Migdałek, J., Stolińska, A., Academic Publishing House of the Pedagogical University of Cracow, Cracow, 2011, pp.255-257. ISBN 978-83-7271-649-1 [In Polish]
- Roszak, M., Kołodziejczak, B., Kowalewski, W., Ren-Kurc, A., 2013: Standard Question and Test Interoperability (QTI) – the evaluation of student's knowledge. E-mentor, No. 2 (49), 2013, pp.35-40. ISSN 1731-6758 [In Polish]
- Roszak, M., Kołodziejczak, B., Ren-Kurc, A., Kowalewski, W., Bręborowicz, A., 2013: Repetitions and summaries in distance learning materials. Learning Content Development System (LCDS). E-mentor, No. 1 (48), 2013, pp.40-46. ISSN 1731-6758 [In Polish]
- Rusek, M., 2011: Methods for rapid development of courses for higher education. Technologies and e-learning tools, Sc. ed.: Ochnio, L., Orłowski, A., Publishing House of SGGW, Warsaw, 2011, pp.142-149. ISBN 978-83-7583-277-8 [In Polish]
- Shank, P., Bircher, J., 2009: *Essential Articulate Studio '09*. Wordware Publishing, Inc., Sudbury, 2009. ISBN 978-1-59822-058-2
- Time to Develop One Hour of Training, available at http://www.astd.org/Publications/Newsletters/Learning-Circuits/Learning-Circuits-Archives/2009/08/Time-to-Develop-One-Hour-of-Training, (accessed on 19 July 2013)

# FORMATION AND DEVELOPMENT OF DISTANCE LEARNING COMPETENCES OF THE FUTURE INFORMATION SCIENCE TEACHERS

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Abstract: Nowadays, informatics competences are used for formation and development of distance learning competences of the future information science teachers. The future information science teachers learn some theoretical and practical aspects of working with distance learning systems during the different courses of study. Integrating of distance learning elements and traditional training of the future information science teachers allows implementing of the blended learning. Distance learning competences are used for formation of skills in working with new computer technologies and for formation of lifelong learning skills.

**Keywords:** distance learning, future information science teachers, informatics competences, distance learning competences, blended learning

#### INTRODUCTION

Modern society is oriented towards the wide use of information and communication technologies (ICT). In this respect, the use of ICT is constantly expanding in school education of many European countries. This trend is also observed in Ukraine. Hence, there is an urgent problem of preparing future teachers for the wide use of ICT in their professional activity.

Besides, distance learning technologies are actively introduced into the learning process of many higher educational institutions and schools recently. This causes solving of the issue concerning specialist training in the field of distance learning.

# 1. ANALYSIS OF DEVELOPMENT ASPECTS OF DISTANCE LEARNING IN UKRAINE

On the basis of Smyrnova-Trybulska (2007) research and personal experience, we can conclude that no higher educational institution (HEI) prepares future distance

learning teachers (tutors) in Ukraine. Unfortunately, the present situation has not changed. The main problems in this area are as follows:

- the existing legislation in the field of distance learning is imperfect;
- programs for training of distance learning tutors are not drawn up at the national level;
- undefined legal status of the distance learning tutor, crude qualification characteristics of the tutor, no methods of the distance learning tutor preparation, no teaching loads norms etc.;
- unified structure of distance courses is undetermined at the national level;
- unelaborated mechanisms of copyright protection and protection of distance courses from distribution of teaching and learning materials via the Internet (without permission of the authors);
- lack of the government attention to this issue causes underfunding, and as a consequence, poor technical equipment of educational institutions.

Nowadays, there are only qualification upgrading courses of distance learning in Ukraine mostly oriented on secondary schools teachers.

The latest legal document (in the field of distance learning) is the Order of the Ministry of Education and Science of Ukraine dated 25/04/2013 "On Approval of Distance Learning Regulations". The document defines the concept of distance learning, its purpose, tasks, and methods of implementation; observes the peculiarities of the organization of distance learning educational process and distance learning provision. Issue of the training of future distance learning tutors is not considered.

Nevertheless, issues concerning distance learning specialist training is not resolved at the national level; it is important to start the training of these teachers right now. Due to the fact that distance technologies are being actively implemented in the education and other areas of society, solving of this issue shall be started with professional development of educators and future teachers who have good skills in ICT using. These students are the future information science teachers.

# 2. PLACE OF DISTANCE LEARNING COMPETENCES IN THE COMPETENCES SYSTEM OF FUTURE INFORMATION SCIENCE TEACHERS

In spite of imperfection of the existing legislation in the field of distance learning, distance learning technologies are being intensively introduced in the learning process of HEI and schools. Scientific and pedagogical project of the Ministry of Education and Science of Ukraine "Distance learning of pupils" was implemented by Bogachkov (2009) on site http://testportal.org.ua/dls.

In this regard, there is an urgent need for training of specialists who have appropriate competences.

For this purpose, it is necessary to conduct training of working teachers and to introduce training of future information science teachers into the areas of use of distance learning technologies.

In our opinion, future information science teachers are the most prepared (between the students) to use distance learning technologies in their future professional activity.

For proving this, we describe the place of distance learning competences in the system of professional competences of future information science teachers. Therefore, we consider the structure of the professional competences of information science teachers.

A lot of researchers separately distinguish informatics competences and ICTcompetences (in the structure of professional competences). We analyze the relation between these concepts.

Spirin (2009) concludes that **informatics competences** is the ability of individuals to satisfy their individual needs and social requirements for the formation of professional and specialized competences in the information science. So, this actually means that informatics competences as subject competences are formed within the process of training of information science specialists and future information science teachers.

Spirin (2009) also defines **ICT-competence** (information and communication and technological competence) as the ability of individuals to practically use ICT for satisfying of their individual needs and for solving of socially important (in particular, professional) tasks in a certain subject area.

Thus, considering professional training of information science teachers, the informatics competences concept is more general and includes the ICT-competences concept, because the ICT-skills is one of the components of scientific knowledge in information science (Spirin 2009).

To find the place of distance learning competences in the system of informatics competences of future information science teachers, we examine the results of the research by scientists who dealt with this issue.

Zhaldak, Ramskyi and Rafalska (2009) conclude that the system of informatics competences (i.e. subject competences) consists of the following components:

- informological and methodological competences;
- information and technological competences;
- computer competences;
- modeling competences;

– algorithmic competences.

Authors (Zhaldak, Ramskyi and Rafalska 2009) consider the following components of the information and technological competences of future information science teachers:

- working with information system (IS), the skills to use ICT;
- working in the area of data protection in the IS;
- skills and abilities of different data types processing;
- working with the basic services of the Internet;
- solving of a various of individually and socially important problems (the use of ICT in the education and research system, etc.);
- working with distance learning technologies.

Spirin (2009) examines the structure of professional and specialized competences (subject competences in information science, i.e. informatics competences) of future information science teachers. The researcher concludes that ICT-competences are included in the technological component:

- general professional competences;
- profiled-oriented competences (scientific subject competences and subjectpedagogical competences);
- technological competences (competences in pedagogical technology and ICT-competences);
- professional and practical competences.

Smyrnova-Trybulska (2007) argues that one of the tasks of formation of informatics competences of future teachers (in particular, future information science teachers) is the formation of distance learning competences.

Smyrnova-Trybulska (2007) defines the main general competences of distance learning tutors, which consist of:

- competences in the area of pedagogy, psychology, and new educational technologies via distance learning;
- ICT-competences and their application in education;
- competences in the use of Internet-technologies.

Apart from that, we can add competences in the area of organizing and managing distance learning to the group of distance learning competencies.

Summarizing, clarifying and specifying of the abovementioned, we can show the system of informatics competences of future information science teachers in Fig. 1:





Source: Own elaboration based on (Zhaldak, Ramskyi and Rafalska 2009, Smyrnova-Trybulska 2007, Spirin 2009)

Thus, considering the abovementioned reasoning, we conclude that distance learning competences are included into informatics competences (in particular, into information and technological competences of future information science teachers).

### **3. CONDITIONS FOR FORMATION OF COMPETENCE IN DISTANCE LEARNING FOR FUTURE INFORMATION SCIENCE TEACHERS**

#### 3.1. Analysis of curriculum for bachelor of informatics

We analyze the curriculum for bachelors of informatics of 0403 "System sciences and Cybernetics", specialty 6.040302 "Information Science\*" (qualification "information science teacher") to determine which distance learning competences can be gained by future information science teachers within the process of their training.

Curriculum for bachelors of informatics and future information science teachers consists of three cycles:

- 1. Cycle of humanistic and socioeconomic training.
- 2. Cycle of science and mathematics training.

#### 3. Cycle of professional and practical training:

- 3.1. Cycle of psychological and pedagogical disciplines.
- 3.2. Cycle of objectively and professionally oriented methodical disciplines.
- 3.3. Cycle of subject (informatics) training disciplines.
- 3.4. Special courses and elective courses.

The fragment of the curriculum is shown in Figure 2:



# Figure 2. The fragment of the curriculum for bachelors of informatics and future information science teachers

Source: Curriculum for bachelors of informatics

It should be noted that the formation of the basic informatics competences, which conduces to the formation and development of distance learning competences of students, occur in the process of learning disciplines of the professional and practical training cycle.

Number of hours for informatics, subject-methodological, psychological, and pedagogical disciplines (provided by the curriculum for training of information science teachers) is shown in Table 1:

#### Table 1.

#### Number of hours for informatics, subject-methodological, psychological, and pedagogical disciplines provided by the curriculum for training of information science teachers)

Nº	Academic discipline	Course	Number of hours / ECTS credits	Final control
Uni trai	t of professional psychological ning of students	and pedagogic	al and subject	t-methodological
1.	Psychology	1, 2	324 / 9	tests
2.	Pedagogy	1, 2	216/6	examination, test
3.	Methods of Subjects Learning	3, 4	540 / 15	tests, examinations
	TOTAL:		1080 / 30	
Uni	t of professional scientific and sub	ject (informatics)	training of stud	lents
4.	Computer Science	1	144 / 4	tests
5.	ICT	1	288 / 8	tests
6.	Programming	2, 3	576 / 16	examinations, tests
7.	Computer Networks and the Internet	2	180 / 5	examination
8.	Computer Architecture and Configuration of Computer Systems	2	216/6	test
9.	Computer Simulation	4	180 / 5	test
10.	Selected Issues of Informatics (elective course)	3	234 / 6,5	examination, test
11.	Selected Issues of Computer Engineering (elective course)	3	234 / 6,5	examination, test
12.	Selected Issues of Object- Oriented Information Technology and Programming (elective course)	4	216/6	test
13.	Selected Issues of pedagogical technology (elective course)	4	108 / 3	test

Nº	Academic discipline	Course	Number of hours / ECTS credits	Final control
14.	Information Resources Protection	2	162 / 4,5	test
15.	Mathematical Informatics	3	126 / 3,5	examination
16.	Computer-oriented learning systems of Natural Sciences	4	162 / 4,5	examination
17.	Special laboratory course of informatics	4	162 / 4,5	test
	TOTAL:		2988 / 83	
Uni	t of practical training of students			
18.	Teaching Practice	4	486 / 13,5	reporting form
19.	The Practice for Creating Multimedia Learning Means	3, 4	162 / 4,5	reporting form
	TOTAL:		648 / 18	
TO	TAL for Units:		4716 / 131	

Source: Curriculum for bachelors of informatics

The curriculum totally provides for 7884 hours / 219 ECTS. Thus, the number of hours for informatics and subject-methodological disciplines (4716 hours / 131 credits ECTS) is more than half of all the hours. This makes provision for sufficient professional training of students in the area of psychological and pedagogical disciplines, informatics profiled disciplines, professionally-oriented and methodical subjects, ICT and the use of Internet-technologies.

# **3.2.** Formation of distance learning competences of future information science teachers via blended learning

The curriculum for bachelors of informatics has been analyzed in the previous subchapter of this article. Also, it is necessary to describe the knowledge and skills which conduces to the formation and development of students' distance learning competences according to disciplines within which they are formed. This is shown in Table 2.

# Table 2.

# Analysis of the knowledge, ability and skills that conduces to the formation of students' distance learning competences

Nº	Summary of knowledge, ability and skills	Academic discipline	Course
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Nº	Summary of knowledge, ability and skills	Academic discipline	Course
1.	General information about distance learning, its application in the learning process, principles of organization, characteristics of distance learning systems, etc.	<ul> <li>Computer Networks and the Internet</li> <li>Selected Issues of pedagogical technology</li> </ul>	2 4
2.	The ability and skills to use distance learning technology in own learning activities (for getting of learning materials, passing of questionnaire survey, and testing, etc.)	All the disciplines of the Table 1, except for psychology and pedagogy. Also under development is a resource for interaction between students with teachers and other students during teaching practice	1-4
3.	The ability and skills to create certain elements of the distance course	<ul> <li>Computer-oriented learning systems of Natural Sciences</li> <li>Methods of Informatics Learning</li> </ul>	4 3, 4
		• The Practice for Creating Multimedia Learning Means	3,4
4.	The ability and skills to process data in different forms, convert and prepare learning materials for publication on the Internet by using different software	<ul> <li>Computer Science</li> <li>ICT</li> <li>The Practice for Creating Multimedia Learning Means</li> </ul>	1 1 3, 4
5.	The ability and skills to create some themes of distance course to support training of pupils	• Computer-oriented learning systems of Natural Sciences	4
6.	The ability and skills to design and create the structure of the distance course	• Computer-oriented learning systems of Natural Sciences	4
7.	The ability and skills to organize of distance learning system operation and maintain availability of this system	<ul> <li>Computer Networks and the Internet</li> <li>Selected Issues of Computer Engineering</li> </ul>	2 3
8.	The ability and skills to use telecommunications means of the Internet and distance learning system for interaction	<ul><li>Computer Networks and the Internet</li><li>Computer-oriented learning</li></ul>	2 4

N⁰	Summary of knowledge, ability and skills	Academic discipline	Course
	between teachers and students	<ul><li>systems of Natural Sciences</li><li>Selected Issues of pedagogical technology</li></ul>	4
		• Selected Issues of Computer Engineering	3
		• Selected Issues of Object- Oriented Information Technology and Programming	4
9.	The ability and skills of information "navigation" to search and process data on the Internet, and to work with informational and educational resources	<ul> <li>Computer Networks and the Internet</li> <li>In fact, these skills are fragmentarily gained by the students during the learning process almost of all professional-oriented courses</li> </ul>	2

#### Source: Own elaboration

Based on Table 2, we can conclude that following components of distance learning competences are formed due to the process of professional and practical training of the students:

- high level competences in the use of Internet-technologies;
- partial competences in the area of pedagogy and psychology via distance learning;
- insufficient (almost not formed) competences in the area of organizing and managing of distance learning.

As can be seen from Table 2, future teachers, starting from the first-year course in HEI, learn to effectively use modern ICT and distance technologies. They study pedagogy, psychology, modern educational technologies, and methods of teaching of basic subjects (mathematics, physics) with ICT using. So, students of informatics specialties are the most psychologically and professionally prepared to get qualification of distance learning tutor in future.

Working with the distance learning systems, such as Moodle, is an effective tool for formation, developing and improving of distance learning competences of future information science teachers. We will consider implementation conditions of this in Dragomanov National Pedagogical University (Kyiv, Ukraine).

Teachers of Institute of Informatics in Dragomanov National Pedagogical University add elements of distance learning to traditional training of the students. Educators and learners work with distance learning system Moodle (http://www.moodle.ii.npu.edu.ua). By that, educators implement the blended learning.

According to the practice and researches, the current trend of full-time education is firmly evolving towards blended learning. Blended learning combines traditional and distance learning means. The idea of using distance learning elements in blended learning lies in the fact that students learn a certain portion of disciplines by means of traditional forms of learning, and the rest by the disciplines with the use of network technologies.

Blended learning is practiced as an element of full-time education during classroom and self-dependent work of students at the Institute of Informatics in Dragomanov National Pedagogical University (Kyiv).

Thus, integration of distance learning elements into traditional training allows not only implementing of the blended learning and gaining of relevant distance learning competences by students, but also formation of skills in working with new ICT and continuing education skills.

Based on these researches, we can conclude that future information science teachers, who get qualification of bachelor of informatics, are the most prepared to use distance learning technologies in their future professional activity. Distance learning competences of students are formed and developed during the learning process. This can allow them to be qualified as distance learning tutors in the future.

# 4. CONCLUSION

Based on the conducted research, we consider that future information science teachers are not only ready for active use of distance technologies for their learning, but also for getting qualification of the distance learning tutor in their further education; since they gain appropriate distance learning competences within the training process.

Based on the analysis of researchers (Smyrnova-Trybulska 2007, Polat 2004, etc.) as well as on personal experience, developing of relevant courses content is planned in the following areas:

- 1. Distance Education in Ukraine and abroad.
- 2. Basics of distance education and learning. Characteristics of distance learning systems.
- 3. Methods and didactics of distance learning.
- 4. Theoretical and practical aspects of organizing and managing of distance learning process.

- 5. ICT, telecommunications networks, the computer network Internet, and possibility of their use via distance learning.
- 6. Pedagogical monitoring, evaluation of the effectiveness of the learning process via distance learning.
- 7. The modern person-oriented forms and methods of training in distance learning.

Our further research concerning this problem shall be focused on exploration of foreign experience in training of distance learning tutors, development of the curriculum, training programs and courses for the specialization *Distance Learning Tutor* (taking into account this experience), and introduction of these ideas to the learning process of the Institute of Informatics in Dragomanov National Pedagogical University (Kyiv), in particular, in the learning process of future information science teachers.

#### REFERENCES

- Bogachkov, V.Y., Bykov, V.O., Krasnoshapka, V.O., Kuharenko V.M., & Pasikhov, Y.Y., 2009: Project concept "Distance Learning of pupils". Information Technologies and Learning Tools, 5 (13), 2009, available at http://www.ime.edu-ua.net/em.html (accessed on 01 August 2013). ISSN: 2076-8184 [In Ukrainian]
- Polat, E.S., Buharkina, M.Y., Moiseeva, M.V. et al., 2004: *Theory and practice of distance learning: textbook for students of higher schools.* Publishing Center "Academy", Moscow, 2004, 416 p. [In Russian]
- Smyrnova-Trybulska, E.N., 2007: Basics of Developing the Information Competences of Teachers in the Field of Distance Learning. Monograph. Ailant, Kherson, 2007, 704 p., ISBN: 966-630-040-1 [In Russian]
- Spirin, O.M., 2009: Information and communication and informatics competences as components of the system of professionally specialized competences of informatics teacher. Information Technologies and Learning Tools, 5 (13), 2009, available at http://journal.iitta.gov.ua/index.php/itlt/article /viewFile/183/169 (accessed on 01 August 2013), ISSN: 2076-8184 [In Ukrainian]
- Zhaldak, M.I., Ramskyi, Y.S., & Rafalska, M.V., 2009: Model of social and professional competences of information science teacher trainers. Scientific journal of Dragomanov National Pedagogical University. Series 2: Computer-oriented Learning Systems, 7 (14), 2009, pp. 3-10. [In Ukrainian]
## HIGH SCHOOL TEACHERS' INFORMATION COMPETENCIES IN THE VIRTUAL LEARNING ENVIRONMENT

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**Abstract:** The paper describes the new competences which enable high school teachers to use and develop the virtual learning environment. They are: the skills to create the electronic resource base of the virtual learning environment; the initiation and maintenance of students' educational network communication; the educational activities management; the virtual professional community management; the educational problems management.

Keywords: virtual learning environment, competences, high school

#### **INTRODUCTION**

The successful development of a university information environment depends not only on its strategic planning, but also on teachers' performance. It is important for teachers to be aware of their own role in this complex process and to have a certain level of information culture. Today a special role in the educational process is delegated to students' independent work and the individualization of their educational routes. The modern informational resources and networking technologies have a high potential to improve the efficiency of social interactions, educational and professional mobility.

In the definition of information competencies of modern high school teacher the psycho didactic approach is used (Noskova 2007). According to this approach the basic concepts of the educational environment interactions are considered as follows: *social information* in the context of the electronic educational resources development; *communications*, in the space of virtual interactions within various classes of educational tasks; flexible *educational management activities* in the network environment with the use of diverse feedback, based on telecommunications.

Changing of information environment of the educational process requires a significant change in the implementation of educational activities. The solution is a blended form of training. Along with studies in the classroom, the remote forms of interaction are used to stimulate self-organization of students' extracurricular activities. Consequently, teachers need new information competencies that provide the opportunity to include multi-format educational resources in the learning process, to organize educational network communication and to manage the activities of students in a distributed interaction. These are the main vectors of information competencies expansion in the virtual learning environment.

#### 1. THE MAIN VECTORS OF INFORMATION COMPETENCIES EXPANSION IN THE VIRTUAL LEARNING ENVIRONMENT

#### 1.1 The resources design

The first of the new information competencies is associated with the skills to *create* "high-quality" electronic resource base of the virtual learning environment. The design of the electronic educational resources and their inclusion into the learning process needs the awareness of the psychological characteristics of the interaction with the electronic content. Electronic resources are needed to ensure the students' deliberate choice of educational preferences, to update the individual cognitive style of work, to develop the effective forms of modern information behavior. In this situation teachers facilitate the rational use of institutional and global information resources (digital libraries, educational portals, sites, data and knowledge bases, open educational resources). In some educational situations, teachers design their own original resources.

Thus, modern teachers must be prepared to design and build *the resource base* of the educational process. This readiness includes the knowledge of the e-learning potential and the implementation of active pedagogical techniques that are effective in the virtual educational environment. Teachers should solve the problems associated with resource dynamic updating, operational inclusion of new knowledge and flexible adjustment to the current pedagogical tasks.

#### 1.2 The communication organization

The second information competence is associated with the *initiation and maintenance of students' educational network communication*. Network communication does not mean simply the information exchanges with the use of technical services. In focus are the network interactions leading to the new educational outcomes. To build such interactions it is important to understand the psychological mechanisms that motivate actors to active social interaction in the Internet; to model the educational situations of high communication activity for students. Communicational capacity of the learning environment allows organizing group and individual interactions. Teachers need to learn how to perform the communicative acts not only in the direct interactions with students, but also in the

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community of self-learning students. These activities include: the design, the organization and support of group communications in the network environment; the individualized support of students. Expansion of the social partners can enrich the educational communication with the new meanings, attitudes, and values. The network communication during the educational and professional social partnership gives students the ability to position themselves in the virtual space (to discuss, to work together, etc). Accordingly, teachers should not be the "communication center", but preferably act as moderators and facilitators of students' independent educational communication.

#### 1.3 The educational activities management

The third information competence is related to the *educational activities management in the network environment*. The network environment has a fundamentally different psychological basis of educational interactions - distributed interactions between teachers and learners. In a classroom teachers clearly define and control all the activities of a group of students: synchronize their actions, monitor the progress of their work, and quickly make all the necessary corrections. In the networked environment these control mechanisms practically do not work (except for the synchronous network interactions, the weight of which is relatively small). So teachers need to be conscious of the psychological basis of the educational activities in the virtual learning environment. Self-organization and self-management activities have the leading role: without students' active subject position learning in the network environment is not effective enough. Therefore, the active promotion of students' position is one of the central objectives pursued both in the classroom and in the extracurricular educational interactions.

In the networked environment the special managing tools can be used to solve the problems of interactions: databases, network organizers, reminder services, etc. The system of pedagogical management promotes the support of the multiple feedbacks in the network environment. The feedback includes not only demonstration of cognitive processes, but also the characteristics of motivational and regulatory mental processes (Noskova 2009). Special feature of the network educational environment is the ability to see not only the result but also the process of individual work, which is fixed in the archives of the discussions, educational blogs, wiki-resources, students' e-portfolios. These tools allow to make timed corrections, to establish reflexive relationship between students, to provide an individual student's help. The promotion of learner's active educational position becomes one of the central problems in the network environment. It sets the fundamental changes in the psychological atmosphere of the network interactions and professional teaching style.

Thus, due to versatility and accessibility of the network information and communication tools, teachers should be active creators of the information educational environment with the specified information relationships and interactions. It is considered to be an important element of pedagogical support for

students' independent work. Formation of such an environment modifies the pedagogical work and becomes the new dominant of teachers' professional activities. (Pavlova 2010). In such an environment direct educational interactions require the complementation of the telecommunications. The system changes should affect the activities in the classroom. Teachers will be able to shift the focus from the presentation of educational information to the interpretive commentary, discussion of problems, students' motivation to further research. However, this requires new teachers' skills to see and understand the behavior of students in the educational process, which is due to the use of network technology, distributed in time and space. Teachers must take into account that the psychological aspects (interests, motives, attitudes) of students' activities based on the electronic media differ from the traditional characteristic of classroom interactions. Pedagogical vision of students' network behavior helps to optimize the activities of students with different cognitive styles, leading sensory modalities, different strategies of cognitive processes. At the same time it requires a high degree of understanding benefits and risks of the network communication technology use. In other words, teachers help to create personal, psychologically comfortable and efficient telecommunications environment of educational interactions.

#### 1.4 The virtual professional community management

The fourth information competence is connected with the virtual professional community management. The networked information environment was originally intended not for individual activities but for the distributed interaction. To achieve significant results such interactions require certain distributed efforts. The distributed cooperation of colleagues gives the information support for teaching activities, expands interdisciplinary communications in the process of learning and teaching, and enhances the creative approach to teaching through ongoing professional exchange. The main features of the current educational situation are the intensification of knowledge, the update of new educational goals, the emergence of the variety of communication tools. So the main condition for the pedagogical activities success is the continuous development of professional competence and self-education. The network environment allows teachers to have quick access for the most relevant professional information and innovative experience of colleagues (in the online discussions, the blogosphere, the pages of professional sites, in the joint distributed work). Therefore, the virtual learning environment is not only the source of the new information and knowledge for students, but also the virtual laboratory for teachers' reflexive improves and innovative teaching ideas.

It is important to note that the electronic environment is not static. It should include the possibilities of dynamic updates, adjustments to changing pedagogical tasks, quick inclusion of new knowledge and activities. Therefore, in the virtual learning environment, teachers have to be mobile and constantly developing. It is especially relevant for the university teachers, who train future professionals for the labor market. They should teach students to disclose the potential of the modern educational environment. The high quality of educational services can be achieved if teachers react dynamically and systematically, transform activities in accordance with the changes in the global information space. It is not enough to acquire information skills. The whole evaluation of the education activities must change. In teaching the values are referred to as "the rules governing the teaching career and emerging as a cognitive-functioning system that serves as a media between the prevailing social outlook in the field of education and the activities of the teacher" (Rapatsevich 2001). Formation of values and professional targets is a complex process of interaction and understanding of the changes in processes involving teachers and students. Teachers must be aware of current trends in the development of modern education and related requirements; be aware of causes and effects of the informatization. Teachers need to possess the new ways of solving professional problems, within knowledge-intensive computing methods. It is the new way of professional thinking. (Noskova 2007).

#### 1.5 The Educational Problems Management

The fifth information competence is the preparedness for the *educational problems management*. There are several approaches that enable productive educational problems management. Firstly, in the network environment a special value gets the indirect influence on the personality of the subjects – their motivations, incentives, collisions, positions. This kind of techniques is often used by social workers. This mechanism is adequate to the network environment and more efficient for today's youth. Secondly, the network environment leaders (the most popular authors of opinions) have a productive influence on the subjects of the medium. Authoritative communicators (such as social partners, successful alumni, employers) can also influence. Thirdly, relevant approaches to the educational problems can be taken from the social media, particularly social networks.

If we transfer the technologies and methods of electronic media to the university corporate media environment we can help young people to adapt to the life in the global media environment (Noskova, Yakovleva 2012). Firstly, it is needed to create the conditions for the preparation for the correct, critical perception of information. Secondly, it is important to create conditions in which students acquire the skills of the acquisition of electronic media language in social and professional problems. Mass media methods help to solve some important problems of education and professionalization in the media environment of the modern university.

#### CONCLUSION

What strategy can teachers choose to design the virtual environment for education and interaction? There are two concepts of rising and falling design strategies. The upward strategy involves the movement from the holistic vision of the image to the elaboration of its structural details. Downward strategy, in contrast, focuses on the connection of the individual components together. Further practical changes in teaching depend on the version teachers prefer (the holistic predictive model of the virtual environment educational activities or the generalized model of the environment with some well developed pedagogical information components).

In the design of the activities in the network environment teachers use the terms of the new collective subjects of networking, such as "network group," "virtual classroom", "network class", "distributed audience," "online community" and so on. Remote interaction requires significant adaptation of teaching methods and technologies developed and described with reference to the traditional environment. Special attention is paid to the support of students' initiative - new types of network information activities in the environment. The main quality of the designed environment is its network construction principle, which corresponds to the laws of the development of modern information structures. It means that not all information and communication should be and may be predetermined. They arise in the course of interaction, depending on the activity, interest and readiness of subjects. It is necessary to take into account the processes, taking place in the self-organizing systems. Therefore, teachers not only plan in detail the interaction in the networked learning community, but also understand the trends and see the processes, which can be influenced (Noskova, Pavlova 2012).

The design of the virtual learning environment is seen as gradual, step by step process. It is hardly possible to expect the sudden changes in the activities of experienced teachers. Practical inclusion of innovative tools in the learning process requires teachers' "living" in the new conditions, striving for forward-looking educational goals.

#### REFERENCES

- Noskova, T., N., 2007: *Psychodidactics of the educational environment*. HSPU Publishing House, St. Petersburg, pp. 171. ISBN: 978-5-8064-1243-1
- Noskova, T., N., Pavlova, T., B., 2012: New priorities of the educational activities in the educational environment of the modern university. Scientific and technical journal SPBSPU, No2, pp. 329-335, ISSN: 1994-2354
- Noskova, T., N., Yakovleva, O., V., 2012: *Mass media and up-bringing in a university corporative environment* Materials of V Congress of Russian Psychological Society, vol. III pp. 365-366, ISBN: 978-5-89573-078-2
- Rapatsevich, E., S., 2001: *Modern dictionary of pedagogy*. "The modern word" Publishing house, Moscow, 720 pp. ISBN: 985-443-481-8

## CREATING PREPAREDNESS OF TEACHERS AND STUDENTS TO THE IMPLEMENTATION E-LEARNING OR DISTANCE LEARNING

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**Abstract:** The article is devoted to the questions of improving the quality of scientific-methodological and organizational support of learning process of internal and external learning by using modern information-communication and distant learning technologies in pedagogical university, forming of e-skills for e-learning for teachers and students. The results of learning of the teaching staff of the university show the will of lecturers to implement e-learning in the university. The results of practical implementation prove the high efficiency of the proposed e-learning course, allow to make implementation of e-learning and distance learning in the university.

**Keywords:** e-learning course, pedagogical university, information-communication, distant learning

#### **INTRODUCTION**

Nowadays the use of e-learning technology in education is put forward on the first place all over the world. Especially it is the most actual for higher educational establishments, where the advantage of modern educational technologies, in particular technology over the traditional system of education is observed. Among the main features of e-learning are: the complexity, the consistency (a complete coverage of target groups, the system solution of organization and provision of e-learning issues), the development of modern educational technologies based on the information educational environment: training in collaboration, problem and project-based learning, creating students' and teachers' portfolios, etc. (Hrom'yak, Vasilenko, Galan 2011, Smyrnova-Trybulska 2007).

It is important to understand that the implementation of various technologies and organizational models of e-learning requires not only the development of information and communication technologies but also the major organizational changes, innovations in personnel policy, improvements of the methodological framework of the whole education process, as well as the development of the teaching tools, which will correspond the aims of modern education and the level of modern ICT. The analysis of the problems which arrise on the way of the effective use of ICT in the higher educational establishments during the educational process has shown the lack of systematic approaches to their solution.

Here is mentioned the balanced coordination of such subsystems as, organizational, regulatory, infrastructural, educational, employment and financial support for implementation of e-learning. The consistency in matters related to support ICT in education on updated level is particularly important due to the deregulation of the velocity of ICT changes, as well as educational technologies and the level of ICT university teaching and administrative staff's competencies.

The implementation of e-learning through the communication network in Ternopil National Pedagogical University for students of different forms of learning can be interpreted as a positive example of effective use of ICT in the learning process. In particular this primarily concerns the full-time students. The extent of this project is confirmed by the fact that more than 5,000 students and more than 500 teachers from 12 departments / institutes of TNPU are enrolled in it.

#### 1. THE BACKGROUNDS OF IMPLEMENTING OF THE ELECTRONIC LEARNING AT THE UNIVERSITY

The successful implementation of e-learning is possible due to the creation and operation of corresponding infrastructure, which is responsible for the realization of organizational, methodological, technological and regulatory activities and during the introduction and implementation of e-learning at the educational establishment. Among the main elements of organizational support for e-learning system has always been the desire and will of the University administration and their support given to the specialized unit — The Centre of Distance Education and New Educational Technologies, whose main task is to coordinate the organizational and technological support of the use of e-learning at the university.

Creation of the necessary infrastructure has begun in the 90s, so the implementation and the development of e-learning took place gradually. We can point out the following stages of the process:

- the organization of computer laboratories and the launching the course "Modern information technologies in the educational process" for all firstyear students;
- the completing classes with multimedia computers;

- the designing and creating of the corporate university network (consolidating classrooms and educational buildings into a single network);
- the implementing of the server platforms (creation of the University website, email, and the control access to the Internet);
- the issuing of the courses in their electronic versions on the university library server;
- the introduction of the use of testing technologies in order to monitor the students' level of knowledge, the development and implementation of automated test control "The Examiner";
- the enacting of the experimental server-based e-courses by the system Moodle for students of the Physics and Mathematics Department of the University;
- the carrying out of the scientific seminars and conferences devoted to the issues of electronic and distance learning;
- the enacting of the server with e-courses for the students of the university on the basis of Moodle;
- the conducting advanced training courses "Methods of creating e-courses in the system Moodle» for more than 500 teaching staff of the university;
- the creation of the Centre for Distance Education and New Educational Technologies;
- the covering by the network Wi-Fi of the campus;
- the conducting of the online conference "E-learning in the educational process: concepts, problems and solutions" by the Department of Informatics and methods of teaching (2010).

#### 2. THE FORMATION OF THE BANK OF ELECTRONIC COURSES

The creation of the bank of electronic courses is based on their modularity for different educational levels - training, retraining and advanced training as well as various teaching scenarios for learning for all forms of study — full-time, part-time or distance. The process of creating e-learning systems (ENK) in TNPU took place in three successive stages:

Step 1 — Training of the university teachers during the training seminar "Methods of creating e-courses in the system MOODLE» covering 72 hours. The workshops were held at the TNPU by the lecturers of chair of computer science and methods of teaching according to the order of the Rector of the University.

Stage 2 — filling ENK with the electronic didactic and teaching resources in full according to the structure, subjects and the curriculum.

Step 3 — approbation of the ENK during the educational term. At this stage, a university teacher uses the ENK materials to educate students and makes all necessary adjustments to the course of study.

Creating the web resources for educational purposes involves all university teachers — they often develop the content of the course and ICT professionals of TNPU help them to design and convert the content into Moodle platform as well as provide other engineering works. Very often teachers create their own web resources for their subjects.

Considering the creation and using of electronic resources there should be considered one of the most complex subsystems in the whole system of e-learning at the university, which is designed to the staff. The difficulties associated with personnel provision with the implementation of e-learning into the educational process, largely depend on the financing of this trend at the university. But this is only one side of the problem. Among another problems are: the conservative attitude of the aging staff, and the lack of ICT expertise and the great teaching load of teachers.

Three years ago there was initiated a special project that provided the mandatory training of all teachers and the heads of departments to acquire the information and communication technologies, which are necessary during the learning process in order to overcome staffing problems at the university. In addition, all of them took the specialized training program (72 hours) — "Methods of creating e-courses in the system MOODLE"; "Computer testing". The training was provided by the department of computer science and methods of teaching.

During the training more than 500 teaching and managerial staff of the University has increased their competence in e-learning. This allowed all university chairs. departments and institutes to begin to develop e-courses and make the first attempts in using the e-learning technologies while working with students. It is the significant pilot project, the aim of which was to create a complete set of web resources for "Informatics" (35 subjects). undergraduate specialty The experience of implementation of e-learning at the History Department was equally valuable. All teachers of the History Department have been trained to create distance learning courses for the platform Moodle, and then they developed 26 distance modules in English, which provide the study of the programs for all university students of different specialties.

However, the teachers' motivation is the most important aspect of the efficient use of e-learning and other ICT in the educational process. This is especially true because of the aging university research and teaching staff in Ukraine.

The motivation of TNPU teachers to improve their ICT skills in order to participate in the creation of Web-resources and the usage of the e-learning/e-testing systems for students is predetermined by the real improvement of the quality of education and by the relief of laborious process after the control of students' performance. All that teachers feel during their first steps of the e-learning implementation in the learning process, and the results are visually can be obtained during the study. In addition, the availability of the certificate about learning, and the using the created web resources in the learning process are taken into account when the competitive selection for the university teaching positions is conducted.

The quality control of the all developed resources is provided by the implemented in TNPU certification system web resources, which evaluates the didactic, methodological and technological components of all elements of the bank.

#### **3. ELECTRONIC STRUCTURE COURSE**

All electronic training courses are hosted on a server of the e-courses of TNPU named after Volodymyr Hnatiuk. URL-address: http://elr.tnpu.edu.ua. The work of the portal is organized on the basis of platform MOODLE. MOODLE (Modular Object Oriented Distance Learning Environment) is the distribution which is widely distributed freely according to the principles of the Open Source license.

Due to this system the student is able to read the online training material that can be presented in the form of different types of information resources (text, video, animation, presentation, e-book), do the tasks and send them to examine, pass electronic testing and more. The teacher has the opportunity to create their own ecourses and conduct training students to send messages, share, collect and examine tasks, maintain electronic registers, estimate and modify various course resources, etc.

The access to the resource server of the e-courses of TNPU is personified. The students and teaching staff get their usernames and passwords from the server administrator. Every student and staff member has access only to e-learning courses on which he/she is registered in order to participate in the learning process. All the users are personally responsible for keeping the confidentiality of usernames and passwords.

The electronic training courses are designed on the platform MOODLE, and can be represented by the electronic resources of two types:

a) the resources assigned to students submitting the content of educational material, such as electronic lectures and multimedia presentations of lectures, guidelines, etc.;

b) the resources, which designed to ensure the revision of the material studied, the formation of skills, the self-assessment and the evaluation of students' educational achievements, such as tasks, tests, surveys, forum and more. All e-learning courses are hosted by electronic courses TNPU have a unified structure that includes: an overview of academic disciplines (work program, evaluation criteria, print and Internet resources, glossary, news, blogs, if necessary, forums, chat rooms etc.);

- the teaching materials for each module:
- the theoretical material (multimedia presentations of lectures, structured elearning materials, electronic lecture notes, a list of printed and online sources, if necessary audio, video and animated learning resources);

- the practical (seminars, laboratory) work (content, guidelines for implementation, the list of individual tasks, the presentation of results of performance and the evaluation criteria);
- the tasks for independent work of students (additional theoretical background, objectives, guidelines for implementation, the list of individual tasks, the presentation of results of performance evaluation criteria);
- the control module (test questions, the task of evaluation criteria and the way the results of performance tests for control);
- the materials for final test (control task or a final test for the monitoring of student per year);
- the additional materials.

The components of e-learning courses include the following educational materials:

General information about the course:

The Educational Programme. The program states the goals and objectives of the course, its content, which is displayed by the name of each module or topic and accompanied with annotations, the number of hours of study designed for each module.

The criteria of evaluation. This contains the information about the methods of evaluation of students' educational attainment in the specific academic discipline, both current and final. Every module specifies the distributed evaluating points for stated assignments corresponding the grading scale.

The printed and online sources. This resource offers basic, advanced printed sources on the subject, and Internet resources.

The Glossary. Here the basic terms of the training course and their definitions are listed and interpreted.

The News. The news is used by teachers in order to announce the events, reports about the changes in the training course and other information relating to the course.

Course contents include the following materials:

The theoretical study material. It includes the following mandatory training resources:

- 1. the structured electronic materials, the content of which reflects the logic of the study course and provides students with theoretical information according to the module in the whole;
- 2. the multi-media presentations of lectures;
- 3. the additional e-learning materials: flash videos, audio and video materials, reference and regulatory documents (forms, templates, standards, regulations, laws, etc.).

Practical (seminars, laboratory) work. There is a list of laboratory (practical seminars) works in the form of individual or separate resources available in the

course materials. Every work includes the detailed instructions about the objectives, which provide the development of certain skills and abilities, which are necessary for mastering topics, the guidelines for their implementation, the presentation of the results of the work performed, the criteria for evaluation of every task. The laboratory work, which requires the necessary special equipment and real objects is usually performed in a classroom, as indicated in the formulation of the problem. The educational materials for practical (seminars, laboratory) work is recommended to create as pdf-files, links to files of various formats and tasks. The result of the executed laboratory (practical) work the students can send to their teacher electronically on the server of electronic courses or submit them in paper form or orally. After reviewing and evaluating assignments teacher puts down the points into the electronic register ENK.

The tasks for independent work. The major part of the training hours in the study of each discipline is given to the independent study. The materials of electronic educational course contain the specially designed tasks for self-fulfillment and other methodological material in order to ensure the quality of students' performance in the discipline. The task is presented in the following form: the text of the task, the presentation of results of performance evaluation criteria, the deadline for executed tasks, the list of additional printed and online sources. The results of the independent student's work can be sent to the teacher electronically on a server of electronic courses or submitted in paper form or orally. After reviewing and evaluating assignments, the teacher puts down the points into electronic register ENK.

The Modular control. To assess the students' knowledge and skills acquired during the course of the study for each module special tests or tasks are used. The results of evaluation of academic achievement of every student are automatically entered into the electronic register after testing.

The Final control — provides the availability of the materials for students' training in order to pass tests, credits and examinations (control task or final test). The results of students' learning assessments are recorded in the electronic register ENK. In the electronic register the lecturer has to establish the categories for evaluation of all kinds of educational activities and determine their volume (in percentage) in accordance to the final assessment in the discipline.

## 4. EXPERIMENT

In order to determine the teachers' attitude to implementation of e-learning in the educational process, their commitment to the creation and usage of e-courses and the ways to improving of the implementation of e-learning in university the survey was introduced in the form of questionnaire.

During the survey two main methods were used:

- the sample design among faculties that use distant learning (home users for sending e-mail, printed form);
- the questionnaire allocation on the server of TNPU e-courses (on-line survey).

The participation in the survey was both voluntary and anonymous. We received responses from 48 teachers working at the seven chairs of TNPU: the chair of social work, the chair of social pedagogy, the chair of mathematical analysis, the chair of mathematics and methods of teaching, the chair of theories and methods of teaching natural sciences, the chair of chemistry and Geoecology and the chair of teaching environmental sciences. The average age of survey participants is aproximately 38 years old. During the survey there were distributed for about 50 printed questionnaires, (of which 36 responses were received), 14 teachers refused to answer questions from a variety of reasons (lack of time, prejudices, etc.). On-line responses were received from 12 respondents.

Most teachers believe that the structure and content of the educational material is changed during the use of e-learning (96% of respondents), but none of the respondents did not indicate the reduction of the content. Most of the respondents (57%) indicated that the structure and content of the educational material has improved, 32% of respondents said that the structure and the content had expanded, and about a quarter of respondents believe they are updated and supplemented in comparison to the traditional way of training.

The issue of educational interaction between teachers and students are frequently discussed in professional literature (Smyrnova-Trybulska 2007, Kuharenko 2007, Polat 2001).

In the traditional way of teaching a sustainable stereotype of psychological and educational interaction has been formed. The e-learning requires from teachers to search for the new approaches (psychological, social, technical, methodological) in order to communicate with the students because of the complexity and multidimensional of this process. It is confirmed by the responders' responses. Only 18% of responders say that communication is "teacher — student" has improved in comparison to the traditional way of training, almost in twice as many (40%) of respondents believe that it is getting worse.

A significant proportion of so-minded professors are the participants of the survey, who represent the chairs of social work and social pedagogy. They fully specify in their unambiguous negative comments the loss of live communication. The simultaneous improvement (the availability of modern methods of communication, their great variety, greater freedom for both students and teachers, the possibility of self-expression, the active role of the student, the intensification of communication) and the deterioration of interaction (the loss of eye contact, the excessive autonomy of students, the weakening educational function) was confirmed by about a third of all the respondents.

Answering the question about the directions of e-learning application, the majority of our respondents (53%) believe that e-learning is useful in the process of the study of almost any disciplines, 32% — only for the humanities, and the rest 15% — for studying disciplines in Nature.

Proving that they have designed and approbated the electronic courses in the system Moodle: "Marketing in Education", "Education for Special Needs", "Social foundations of guidance", "Methods of Teaching Mathematics", "Projective geometry", "Biochemistry and Molecular Biology of the Cell", "Environment" and so on.

The results of the survey as to the methods, which are the most suitable for elearning, confirm the advantage of the following learning methods: searching, planning, researching, collaboration, problem-solving. The above mentioned methods by the survey are actively used in the learning process by all the respondents.

The problem of availability of the primary skills of students while working with distant course has clearly shown the lack of students' preparedness to work independently. When answering this question 89 percent of respondents confirmed the need to develop students' skills of independent work. Almost equally were divided the opinions of respondents who believe that students feel lack computer (29%) and communication (21%) skills. Therefore, we consider it to be advisable to organize the prior psychological support and technical support (e-mail, forums, blogs, etc.), which will be appropriate in order to overcome such obstacles on the initial stages of learning.

The problem of accurate identification of students with remote control expertise is relevant to the majority of surveyed teachers (92%). In order to avoid the fraud by students, most respondents use in their practice certain time restrictions on the fulfilling tasks, select task, demanding creative nature, and in case of doubt — the responders organize repeated oral questioning of students in individual classes. It should be noted that American experts, although they have no examples of fraud attempts, use special methodology to verify authorship (discussion, custom issues, testing, visual contact, checking for plagiarism). (Polat 2001)

The questions about didactic elements which are crucial for the success of e-learning has shown that the teachers consider as the main elements first content, methods and control (32%, 68%, 39%), and only then elements mentioning the purpose and structure. Although these elements are inextricably linked (thus, for example, the form of training defines the methods and tools, the aim and objectives influence the content, etc), however, there is the difference in many aspects between e-learning and traditional one, which leads to a shift in priorities.

In the list of factors that prevent teachers to use e-learning in full in the first place are lack of computer skills (almost half), then — lack of desire and material interest (25%) are mentioned. Some teachers consider that other factors such as

professionalism, creativity, innovation, communication skills are not crucial specially for them. Such responses indicate inadequate computer literacy of teachers and thus, partially explains their biased attitude to their innovative technologies.

Among the factors that promote e-learning in higher education, which were identified by our respondents are the following: information (21%), collaboration (28%), fellow-innovators (10%). However, the highest percentage scored the factors that can be considered as the significant for our university — namely, methodological and technical assistance (34 percent) and administrative support (38 percent).

The impetus for the rapid development of e-learning at the university was conducting training courses "Methods of creating e-course in the system MOODLE", which were held for staff of TNPU by the lecturers of the chair of computer science and methods of teaching.

Answering the questions about the objective and subjective obstacles in the promotion of e-learning also confirmed the positive attitude of the university administration to this problem as far at the administrative factor was not mentioned in any questionnaire. However, for about 50% of respondents believe that primary obstacles for the development of e-learning is the lack of professionals. This suggests that the administration should not stop there and take further steps to successful implementation of e-learning in the educational process, to form a specialized structure responsible for the development of internet technologies, which will constantly provide teachers with the effective support and assistance in their usage of innovative technologies.

The financial and mental factors were noted by 34% of respondents. These data are consistent with the studies carried out by American researchers (Oblinger, Hawkins 2005).

#### CONCLUSION

The study showed that the main positive experience acquired by TNPU as for effective usage of e-learning in the educational process lies in the systematic combination of administrative decisions, institutional mechanisms for coordination between all departments of the university and the motivation of the main participants of the project. The impressions of university teachers about e-learning in general are positive, they are ready for its usage and implementation in the educational process. The main reasons for the complexity of implementing e-learning is a new form of interaction between teachers and students, time-consuming set up in the courses during e-learning, technical factors.

Today every student of TNPU has access to a local network and the Internet. For teaching purposes and didactic support of e-learning bank web resources for educational purposes, including distance learning courses and individual elements such as training programs, multimedia lectures, practical assignments, tests, business games in the university is established. Taking into account the pedagogical profile of the university, the unique place among web resources belongs to the virtual resources based on Web 2.0 technologies.

#### REFERENCES

- Awareness E-Learning 2.0, available at http://www.distancelearning.ru/db/el /3F3FD9A93DE003AB6A3/doc.html (accessed on 23 March 2010).
- Hrom'yak, M., J., Vasilenko, V., Galan, B., Chorniy, 2011: Problems of implementation and use of e-learning in higher education / / Scientific notes of Ternopil National Pedagogical University. V. Hnatiuk. August. Pedagogy. -Ternopil, 2011. - No 1. pp. 191-199 [In Ukrainian]
- Jacobson, V., J., 1998: Lessons Learning and Lessons to be Learned: An Overview of Innovative Network Learning Environments. Proceedings of Ed-Media-98. Charlottesville, VA: AACE, pp. 662-668.
- Kuharenko, V., 2007: An integrated approach to implementing e-learning. Proceedings of the Research Institute of Ukrainian Studies. - K.: Folio, 2007. -T. 18. pp. 77-83 [In Ukrainian]
- New Projects Teaching and Information Technology in the system of education: learning / E. Polat, M. Y. Buharkyna, M. Moiseev, A.E. Petrov, Ed. E. Polat. - Moscow: Publishing center "Academy", 2001. - 272 p. [In Russian]
- Oblinger, D., G., Hawkins, B., L., 2005: *The myth about E-learning*. Educause review / D. G. Oblinger, B. L. Hawkins. 2005, vol. 40 no 4, pp. 14–15.
- Smyrnova-Trybulska, E. N., 2007: Fundamentals of generating information competences of teachers in the field of distance learning. Monograph. Ailant, Kherson, 2007, 704 p., ISBN: 966-630-040-1 [In Russian]

## E-LEARNING AS DISTANCE TRANSFER OF SKILLS AND KNOWLEDGE

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Abstract: Effectiveness is a key component of education. There are various forms and methods of teaching. One of the modern ways is e-learning, which, however, if adopted properly needs taking the series of different actions beforehand. The workers in many fields (scopes) are constantly trained and the basic form of professional training is course. This may be organized in a form of distance learning, which results in educational innovation and cost reduction. The work describes e-learning platforms and portals and their categories: open source and commercial. It presents the model structure of logistics course and discusses conditions which should be met for distance training to be available also for the disabled.

Distance learning is a process where the learner and the tutor are at a certain distance from each other. Distance teaching involves various methods and a direct though virtual contact. Passing teaching content to dispersed groups being trained is the main characteristic. This method reaches beyond strict requirements of traditional teaching dependent on all participants being in one place and time. At presence there are as many supporters as opponents of this method. The group of supporters include mostly enthusiasts and visionaries, for whom delivery (availability) of knowledge (from distance) is in a future the universality of education. They are those who define the fields and directions of its application. They popularize distance learning at conferences and publications, build and develop new educational platforms and collect knowledge data bases.

There are also some opponents who claim that it is not possible to train people properly without personal contact with the tutor (trainer). They also raise the question of legal loopholes, lack of regulations defining copyrights as well as payment regulations for authors of teaching materials created and placed on elearning platforms. Free access to these materials and lack of remuneration do not encourage to work. This time-consuming work on designing knowledge data bases (teaching materials), theoretical and practical knowledge necessary for this is not priced according to law and is simply charity. This factor hinders development of elearning. Also training companies invest money in creating e-learning training courses very carefully. The present stage of e-learning development and economic benefits force this relatively cautious (limited) approach. Managers in training companies estimates e-learning enterprises to be rather risky. Technological advances, competitive market and ensuring universal education of society will influence development of e-learning, popularize and make it attractive.

The most important benefits from adopting e-learning methods are (Kuck 2013):

- central coordination and management of courses, their full availability for trainees, which is now possible on the level of designing, distributing, accounting and controlling,
- standardization of knowledge and information resources, acceleration of transferring new knowledge thanks to training in any place with immediate correcting or providing information tailored to the needs,
- enhanced efficiency of training processes by introducing appealing alternative teaching methods, easy remote controlled access to knowledge for recipients without time and space limits,
- extending, completing, and checking knowledge acquired through traditional means, building up new skills easily by applying *blended learning* method,
- high level of effectiveness by adopting testing tools and certificates and free contact with experts,
- discreet and stress-free training process provided to a student at any time and place,
- better use of resources thanks to detailed analysis of a single person or group competence and skills and matching training process to individual needs of participants,
- cost reduction of preparing teaching materials by using tools for creating individual courses,
- financial benefits thanks to reducing business trip expenses, eliminating travelling and accommodation costs,
- better use of technical and academic capacity of universities and scientific institutes (scientific works, analysis, researches, studies including multimedia and presentations).

Apart from advantages there are also limitations of adopting e-learning: required access to the infrastructure (computer, network) and basic computing skills including good writing skills for solving tests and participating in forums,

- high initial costs of preparation of infrastructure and teaching materials,

- independent training needs, higher motivation and better time management than in case of traditional training,
- in some cases traditional classes are indispensible (computing courses, leadership courses or others requiring practical field trips),
- effective introducing of this methods needs series of organizational (and technical) actions. The most difficult, however, is changing mentality and habits of tutors as well as trainees.

E-learning works very well for teachers, managers, instructors who improve and enhance their qualifications. These groups are "educationally mature" and have their own well-tried self-teaching habits thus enquire new knowledge easier.

Using this method is extremely positive for people who want to extend their education and are determined enough to climb the career ladder. It may serve as a component of traditional methods of teaching for those who use new knowledge and want to develop their qualifications.

In terms of availability distance learning courses may be divided into **synchronous** and **asynchronous**. At the asynchronous courses there is no direct contact between a tutor and trainee. Trainee gains and checks knowledge independently. Tutors only supervise the progress and pace of the teaching process. These courses use the teaching materials on CDs or in the data bases. Communication between an instructor and course participants takes place through e-mail or discussion groups. Synchronous courses are run in a real time. Participants contact an instructor and other participants. This course may take single session or several weeks, months or years. These courses are organized through the Internet, videoconferences or two-way radio broadcast.

In terms of the form courses may be divided into: **closed and open**. Closed courses are ordered by big organizations to train people inside the given institution or company. Open courses are designed for wider groups, e.g.: professional groups, age groups or whole societies.

From the technical point of view one can distinguish **tailor-made or off-the-shelf courses**. The first ones are design to meet to the individual needs. Off-the-shelf courses are ready-made courses with basic professional materials.

E-learning courses are built up from modules called teaching objects. The structure of the course is composed with topics which are the sub-components of the higher elements – lessons and lessons are the sub-components of units. Every element constitutes complete, independent part of the course with its own defined aims, training activities and testing elements. This flexibility allows to compose them freely, modify and design new courses and programs.

Designing a practical system of knowledge management effectively requires a lot of time, engagement and formal preparations. Before the training project is started the real needs should be identified.



Fifure 1. A diagram of the course structure (model)

Source: The elaboration based on: materials by WiedzaNet company

Training projects are created on the basis of the analysis of needs of the organization or institution: workers' qualifications and experience and plans for its development. The key elements of distance learning are:

- trainees, participants,
- instructors/ moderators,
- organization.

The range of e-learning activities may be discussed in three dimensions: **people**, **knowledge and communication** (Tyrała P., Olak A. 2012). Each of them is in scope of IT solutions built up for single needs and expectations of an individual client. Generally, teaching materials provided in e-learning are in the form of a course. This course content has precisely defined structure, enriched with different interactive and multimedia elements which are to enhance the quality of training. This system includes various solutions for the analysis and full control of the training process. Thus, proper designing of the e-learning course is one of the key factors influencing the successful introduction of e-learning in an organization or institution. It demands a lot of work but the effects may often surprise the authors

themselves. The process of designing an e-learning course may be divided into the following consecutive stages (Kuck J. 2013):

- creating the general concept,
- working out and verifying a training model,
- preparing and sorting out the materials,
- planning the syllabus,
- defining a method and the way of providing the material,
- designing the teaching modules,
- testing and assessment.

**There are 17 rules how to design a good online course** (Chmielewski, Stanisławska 2012):

- information about the course is provided online, people interested in it have an access to the description of this course and the person responsible for further details,
- every course consists of pre-training in navigation and using the functions; this pre-training should be about how to use the course and also how to communicate with other participants,
- the basic description of a course includes: title, name and contact data of the person running the course, starting date, length of the course and estimated time the participant should devote, bibliography, materials and description of tasks and content, exam schedule and assessment system,
- the materials are presented in a simple, clear, appealing, dynamic and wellorganized way with visual materials and multimedia tools,
- reference to the interesting websites should encourage students to explore other content connected with the course,
- single hyperlinks expand basic information and the transition from one lesson to another is fluent,
- presented materials are interesting, colorful (graphics, films, team work or project, discussion groups),
- while designing the course one should consider different learning styles (visual, audile, kinesthetic),
- the material is logically presented and the navigation simple,
- communication with the tutor is fast and easy,
- there is possibility to exchange information via chat, open discussion,

- the course must attract trainees' attention and keep them interested,
- online materials must be professional as they reflects on the quality of tutors' work,
- passage between pages is fluent,
- the experts from outside may take part in the course,
- testing should be relevant to the type of course, e.g.: giving short time for the answer,
- a tutor monitors how often and when a trainee uses a course.

After the training (course) is prepared according to these rules it can be placed on an e-learning platform. The most popular of all the platforms available on the market are those with the required functions. It is definitely cheaper and easier to use already designed functions rather than to built them oneself. Additionally, if this solution is tested and commonly used we can draw on other's experience and gain the support of the software producers. The other criteria for choosing the right platform are: if the product (software) is long-established on the market, reliable and if there is possibility to exchange experience. E-learning platforms can be divided into open source and commercial. **Open source platforms** strongly influence the development of e-learning – this solution is adopted (mainly for economic reasons) by academic circles. The most popular are Moodle, Illias, and Clariline platforms.

In practice following the example of universities e-learning in organizations and institutions can be organized by the MOODLE platform (Modular Object Oriented Distance Learning Environment). This platform is a modular, dynamic, object-oriented teaching environment designed to create and run courses via the Internet. MOODLE is an interactive and modern platform that may support traditional methods and at the same time boost their effectiveness. This solution gives possibility to built flexible courses with discussion groups, registers, surveys, materials, task and projects provided online. This platform is available in many languages, has simple interface and requires basic computing skills to use web browsers. It can be used for comprehensive online courses and as a supplement for traditional courses. This platform is applied at more than 36,000 universities and educational institutions and in 196 countries ( the number in 2009).

The second most popular platform is **Ilias**, which name derives from German word for Iliad. translated *Integriertes* Learn *Informations* as und Arbeitskooperationssystem- integrated information and cooperation system for education via the Internet. It was created in 2000 as a part of the project VIRTUS at University of Cologne. The new vestions of this platform have been designed since then on. At present, Ilias makes the project of several educational institutions, mainly in Germany, France and Switzerland and a few commercial partners. Ilias offers possibility to design courses effectively and many attractive soulutions not available on different platforms. It includes standardized templates and materials

indispensible to create the course, such as an integrated navigation and administration system. The advantage of this platform is also the mechanizms for creating moduls based on XML (Extensible Markup Language - is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable). These moduls comprise teaching materials in a multimedia form. Every participant of the course on Ilias platform is equipped with their own desktop for necessary resources e.g.: e-mails, notes, bookmark, Google maps, chanel network, podcast management. This platform tools allows for the comprehensive management of the course, resources and users. In Poland this platform has bed implemented by Gdynia Maritime University and National Defence University (Szabłowski S. 2009).

**Claroline** – another open source platform (translated into 35 languages, with access for users in 93 countries). Likewise two previously mentioned platforms it is also popular in academic and business circles. It can be adopted to individual needs. The course is designed on the basis of the path defining points, stages of moving though single elements. Course is modul based (course description, calendar, notices, documents, exercisers, tasks, homework, groups, users, chat). The user knowledge acquisition may be controlled by various kinds of tests, final works, statistics system (Plebańska M. 2013.

**Olat** is the open source platform written in Java and offers all main standards also in Polish language. OLAT platform (*Online Learning And Training*) is a software which can be applied as a tool for full online courses or as a support for traditional teaching process. Managing materials and students with Olat is easy as the courses created are flexible and their monitoring dynamic. This facilitates not only distance learning but also smooth mutual flow of information from a tutor to students and from students to a tutor. The courses come up to expectations of recipients. With the built-in editor it is possible to prepare short seminars on a given topic as well as lectures long and complex in structure. The main characteristics of the program are the following:

- easy operating system, vivid user interface with the system specification,
- flexible system for course managing and creating teaching materials,
- archiving course content and elements (import/export of courses),
- managing system and access to content in any search engine supporting technologies: XHTML, XSLT, CSS2, JavaScript 1.7, Java, frames, XML and JPG, GIF, PNG graphic formats,
- system with central access (LMS system installed in DataCenter, network access from any single place on Internet and user intranet),
- modular structure and possibility to integrate it with other systems operating in a client's IT system,

- modern technologies used for building this platform (Ajax, Web2.0, DHTML),
- possibility to develop the system (work in cluster),
- conformity with current communication standards (SCORM, IMS, AICC),
- multilanguage user interface (Polish, English, German, Spanish, Italian, French, Russian) with possibility to operate UTF-8 Multilanguage typeface,
- managing users, groups and roles,
- possibility to create working groups,
- unlimited number of system users,
- possibility to create accounts without users (independent registration),
- sharing resources with other LMS platform users,
- possibility to customize page graphic.

Open source platforms are suitable alternative for school education. Proper application of IT tools and teacher creativity make the course substantially and methodologically valuable. The second group of educational platforms are commercial platforms created by companies which sell them implemented in their own model or under licence. They are very popular in big corporations and organizations and considered more reliable and trustworthy as they are assigned by well known brands. Moreover, this solution is purchased together with professional training on how to operate the platform, thematic conferences, service and technical assistance with implementing and using the system later on (Paprocki, Łojewski 2009).

**Fronter** ia an education platform used by over 3500 educational institutions in Europe. **It offers package of about 90 tools selected by experts from many countries**. Their cooperation results in new ideas, innovative concepts and technologies useful in education. After analysis they are embedded into new versions of the platform.

The idea to built this platform arose in Norway in 1998. Nowadays, the Fronter community has millions of users. Platforms provides solutions in a simple, open and professional way. Its simple interface enables users to work effectively after a short training. Fronter aims at providing professional products and services. At the same time it promotes communication and cooperation offering tools for development and methods for delivery and action. Professional trainers responsible for developing the platform with groups of experts create the application which meet the increasing demands of the society. **Fronter being a commercial product is user-friendly and can be used intuitively. Its visual merits and ergonomy make it compatible with modern Internet applications**.

**Blackboard** – a commercial platform created in New York, used by about 5 thousand institutions in 60 countries. It is educational system online with a set of tools for creating and managing teaching content. Blackboard Learn<sup>TM</sup> Platform provides efficient tools to create attractive and effective online courses which meet students' needs. The platform fosters cooperation of students creating lively communities beyond the classroom and facilitates managing and sharing valuable materials within the whole organization. The main characteristics of the platform are (Plebańska 2013):

- teaching content is organized and adopted to the traditional system (lectures, workshops, seminars, timetable),
- system of monitoring progress and assessing is adjusted to the needs (marking after each class, at the end of the thematic block, or semester),
- the knowledge can be tested by online exams with time measured and results generated in points,
- there is also "notice board" allocated for information about (e.g.: deadlines for final work).

**Blackboard** enables users to join courses into one "educational path". There is wide variety of materials available (including texts, graphic, animation, video and audio recordings, presentations supported by Java language or Flash technique). This platform is also equipped with reporting systems monitoring users' activity. One of them is an evaluation survey to assess quality of training.

Lotus Learning Space 5.0 is designed to organize trainings of all kinds. It is a comprehensive, educational solution for creating and managing online courses and offers numerous possibilities: while using given method the course can be available to students, standard and individually designed courses can be integrated, assessment and management of the whole process is also possible. It supports manager's work providing sales departments with information about new products and effective ways of selling them. The system enables workers to familiarize themselves with latest regulations binding in the company. Lotus integrates attractive high quality content which is an indispensible component of the whole educational process. It is a central point integrating all resources of distance learning.

Variety of e-learning solutions shows that the e-learning market is well developed and growing and it has been successfully established in both world and Polish reality. A big advantage of different kinds of platforms is that they have an interface in Polish language which makes work, learning and gaining new skills much easier. In spite of the fact that there are open source and commercial platforms both methods have numerous possibilities. Development of open source platforms equals brand commercial platforms. **E-learning is very successful in many countries. The point is to be well prepared not only technically but first of all mentally when adopting it**. As the example, e-learning may be implemented in many fields (organizations, institutions or companies) to facilitate trainings or self-teaching, etc. It can range over single organizational levels (e.g.: in the national and international security system – strategic, operational and tactical levels), single services and branches (logistics, HR, finances, etc.). Adopting e-learning for training workers will create new quality of future actions. Well prepared professionals will act more effectively in difficult situations, which can often save lives of many victims and in companies and organizations bring notable organizational and economic benefits.





#### Source: Own elaboration

Preparation of ready-made thematic blocks (Figure 2) for the management board should standardize training. Multimedia data base of means and resources will inform workers about modern equipment. This base can serve as online thematic base for basic and supplementary trainings, self-teaching and preparing for different tasks on a given post. The characteristic of e-learning courses is possibility to present teaching material hierarchically. The course materials and testing elements

are depicted in a form of a tree. This way of organizing and grouping knowledge serves as a contents, which makes navigating and searching for necessary materials easier.

The courses and knowledge data bases should be created in a way to make them available also for the disabled. The designers should acknowledge this reasoning. Requirements were precisely and exhaustively defined in WCAG 2.0 specification (Web Content Accessibility Guidelines 2.0) WCAG are the rules about how to design web pages to meet the needs of the disabled. Since 1999 WCAG 1.0 has been the official recommendation of W3C (World Wide Web Consortium). WCAG 2.0 was worked out by W3C1 organization. WCAG is based mainly on the rules connected with designing WWW pages (Kokoszka 2013):

- In June 2010 colors should not be the only discriminant for information,
- information on www pages should be also available for users operating on out-dated technologies,
- technologies for structure description and presentation should be applied,
- the language used on the page should be marked for using synthesizers converting text into audio files,
- scripts and other objects embedded into page structure should have an interface available for manipulators of different kinds,
- on account of the epileptics, no movable elements should be applied on the page if necessary,
- website should be accessible for computers, speech synthesizers and other devices used by the disabled,
- documents should be in a simple language, legible and clearly outlined,
- navigation should be consistent enough to recognize page structure,
- visual and audio elements should have their equivalents,
- charts should be used only for statistics and written in a way that reading devices could translate them.
- data bases (knowledge bases) should be created according to W3C recommendations to eliminate errors that could pose any difficulty in using these materials by the disabled.
- the regulation on adjusting information on www sites to the needs of the disabled was introduced. It concerns also www pages of public institutions. Companies which do not have to obey this law should also modify information for the disabled. These changes are to be considered in terms of ethical priorities. For private business, being responsible to the public means respecting the needs of the disabled; the hearing impaired or the blind.

E-learning courses should be designed to prevent the increasing phenomenon of "digital exclusion". Fighting "digital exclusion" requires cooperation of many market participants. It is a quite common practice that the needs of the disabled are pushed into the background in spite of the easy access of modern IT systems and technologies. E-learning training should eliminate social inequalities resulting from health problems, religious convictions, culture, age, and sex. The Constitution of the Republic of Poland ensures the disabled the right to specialized help. The changes to prevent social exclusion of the disabled should be about providing access to the Internet as well as considering all their needs by www services designer. The continuous development of social services and the Internet proves these changes are irrevocable. The above-mentioned examples only indicate that the scopes and range for e-learning application are very wide in many fields of our life.

The demand for training for special purposes has been, is and will be high. The access to distance learning will be getting easier and wider with the development of equipment, and advances in IT. Thus, the vision of the next century as the age of permanent self-teaching will come true

The listed examples do not constitute all the possibilities, ways, fields or places where e-learning may be beneficial. Where to locate people responsible for preparation, collection and distribution of teaching materials is still an open question. One of the suggestions is to introduce this method of teaching quickly using the academic and technical capacity. Research studies and published papers would make sufficient teaching materials in this case.

Social determinants for introducing e-learning and Polish accession to the European Union are additional challenges. Experiences of other countries, particularly the USA, the UK, Germany or Australia prove that e-learning may be successfully used to increase the level of education. E-learning can also be treated as a tool to supplement, extend and test the knowledge acquired at traditional trainings.

Nowadays, training with the suggested solutions is not only a fad but urgent need. Let's move from theoretical discussion to practical actions.

## CONCLUSION

Introduction e-learning makes trainings available for the trainees. It is organized on the levels of designing, distribution and assessing and monitoring the courses:

- standardization of information and knowledge resources,
- enhancing their quality and attractiveness,
- developing, supplementing and evaluation of the gained knowledge,
- high efficiency and possibility to adopt these courses for the disabled,
- individual approach to the trainees meeting their expectations,

- cost reduction of preparing teaching materials by using tools for creating individual courses,
- financial benefits thanks to reducing business trip expenses, eliminating travelling and accommodation costs,
- better use of technical and academic capacity of universities and scientific institutes,
- possibility to implement modern e-learning platforms: open source and commercial once.

#### **REFERENCES:**

- Chmielewski A., Stanisławska A.K., 2012: 17 elementów dobrego kursu online [17 elements of good online course], available at http://www.puw.pl, Polish Virtual University, (accessed on 02 December 2012).
- Kokoszka. D., 2013: Modern solutions to support people with a disability hearing and vision - to counteract the phenomenon of the digital divide In: Security in the processes of globalization - today and tomorrow (eds J. Kuck) UKiP J&D Gębka, Katowice 2013, pp. 165-166, ISBN: 978-83-87296-49-0 [In Polish]
- Kuck J., 2013: Nowoczesne technologie w logistyce [Modern technologies in logistics], AON, Warszawa 2013, pp.168-169, 175. ISBN: 987-83-7523-230-1 [In Polish]
- Paprocki K., Łojewski Z., 2009: Ewolucja e-learningu w świetle badań prowadzonych wśród grup studenckich [The evolution of e-learning in the light of research conducted among student groups], Scientific Bulletin of Chełm, nr 1, 2009, [In Polish].
- Plebańska M., 2013: E-learning. Tajniki edukacji na odległość [E-learning. Tricks of the distance education], wyd. C H Beck, pp. 127, 133. ISBN: 9788325519209 [In Polish]
- Potęga możliwości, e-learning w codziennej praktyce liderów. Materiały z III Międzynarodowej konferencji e-learningowej [Power capabilities, e-learning in daily practice leaders. Proceedings of the Third International Conference on E-learning]. Warszawa 2008 [In Polish]
- Szabłowski S., 2009: *E-learning dla nauczycieli [E-learning for teachers]*, Educational Publisher Wydawnictwo Oświatowe [Educational Publisher] FOSZE, Rzeszów 2009 - 2010, pp. 113. ISBN: 978-83-7586-012-2.
- Tyrała P., Olak A., 2012: Prakseologia w edukacji dla bezpieczeństwa [Praxeology in safety education], Wyd. Amelia, Rzeszów 2012 pp. 215-216. ISBN: 978-83-63359-04-1.

## III. PRACTICAL ASPECTS OF DISTANCE LEARNING. DISTANCE LEARNING IN HUMANISTIES

## LIVING AND LEARNING: BLENDING KEY COMPETENCES WITH FOREIGN LANGUAGE LEARNING

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**Abstract:** This article aims at emphasizing the necessity of including competences for lifelong learning in education at any stage and indicates the role of e-learning in this process. The author concentrates on how e-learning facilitates the development of key competences as part of academic education, particularly English language learning. The focus will be on the results of the research conducted by the author in the area of CALL among university students in recent years.

**Keywords:** CALL, Moodle, foreign language learning, key competences, communicative language competence

#### **INTRODUCTION**

"You live and learn" is an often heard reflection made by someone who has just discovered or learned something new. The phrase expresses the person's surprise at the effect of the learning process or discovery. But the expression reflects one unsurprising nature of our life: we never seem to cease learning. In fact we encounter numerous obstacles on our way to knowledge, of which we are painfully aware as we sometimes get a bit disheartened, lazy or perhaps incapable of making another intellectual effort. Indeed, it takes a lot of skill and right attitude to enjoy learning throughout life, especially when we want to stand its pace.

## **1. KEY COMPETENCES IN EDUCATION**

#### 1.1 Let's blend it: learning outcomes including key competences

The area of developing key competences in education, and in particular in language learning, has been highlighted in recent years (Gadomska and Krajka 2012, Kalamarz 2011, 2012). Various reports and studies signal graduates' serious deficiencies in the scope of specific competences, predominantly personal competences (Osiński 2010, Szerlag 2009). Hopefully, academic teaching which has been undergoing serious reconstruction recently, will have to resort to many pedagogical and didactic innovations in order to stand the test of turbulent times (Piasecka 2009, Osinski 2010, Marszałek 2010) or even withstand the avalanche of competitive online education (Warell 2013). A clear prompt seems to be including in the teaching process focus on some vital competences, so apply collected by the Council of Europe in a catalogue of eight key competences: communication in the mother tongue, communication in foreign languages, mathematical competence and basic competences in science and technology, digital competence, learning to learn, social and civic competences, sense of initiative and entrepreneurship, cultural awareness and expression. (Recommendation 2006) What makes them key competences is the fact that they are needed by every individual in order to enjoy self-realisation and personal development, assume an active, civic attitude, achieve social integration and find employment. Starting from the early stages of education and training young people should have enough key competences to prepare themselves for their adult life. This is not a dead end process - key competences should be further developed, maintained and updated within lifelong learning.

#### 1.2 Why computer assisted language learning?

Technology in language learning and teaching has been at stake for decades. Since the early 1980s it has functioned as CALL (Computer Assisted Language Learning), which later on came to include the use of the Internet and web-based tools. The possibilities that ICT offered shifted language teaching to vast possibilities embraced in one term - Technology Enhanced Language Learning. The rapid development of ICT has accelerated the advent of more user-friendly tools and software. Nowadays the computer in language learning and teaching has become nearly invisible, which only proved Steven Bax's prediction of its full integration into the learning process made in 2003 (Bax 2003). Analysing the distinct stages of the development of computer assisted language learning Jarosław Krajka (Krajka 2012) believes that present day CALL, marked by internet technologies and social media, should reflect primarily both the communicative and integrative aspects, not disregarding, however, tasks in the spirit of behaviourism.

What largely contributed to the contemporary CALL is Web 2.0 technologies, which brought out its practical aspect. They triggered off democratization and openness, facilitated co-authoring of applications and helped network communities emerge. There appeared some new instruments enormously facilitating communication,

collaboration, community building, searching and storing information. They include such tools as wiki, blogs, online whiteboard, social bookmarking, video conferencing and others.

From the pedagogical point of view computers in education are justified in many theories ranging from the behavioural theory, through humanistic, to the constructivist theory (Huk 2008) and other contemporary threads such as connectivism (Smyrnova-Trybulska 2012). Guided by the recommendation of complementarity of different concepts of education the contemporary teacher can find its practical application in Virtual Learning Environments where different theoretical conceptions meet to the advantage of the learner. The blended learning mode allows for combining whatever works well for the students in the teacher's pedagogical practice (Kossakowska-Pisarek 2009). This mode creates many possibilities of implementing computer-mediated collaboration in a natural way. With their flexibility and facilitating effect Virtual Learning Environments, such as the Moodle platform create opportunity for introducing many aspects of CMC methods (Smyrnova-Trybulska 2009b).

#### 1.3 Moodle – a perfect blender

How to integrate the focus on developing key competences during language learning classes? Bearing in mind a wide range of benefits of using ICT for the purpose of enhancing the development of particular language skills (Krajka 2007) and considering the powerhouse of blended learning ideas (Sharma and Barret 2009) the posed question can be tackled positively. This can be illustrated by the present author's e-learning course *English for Law* for law students successfully incorporated in the author's academic ELT practice. In the e-course prominence was given to the development of abilities in various language skills and activities in the scope provided by the possibilities of the Moodle platform. The e-course integrated with the traditional classes allowed for achieving promising teaching results especially as they went beyond developing only a foreign language competence. With the holistic approach taken the results corresponded with the developing of other key competences, especially learning to learn. Table 1 shows the relevance of one example of the author's e-course activities with key competence oriented e-learning supported language learning.

#### Table 1.

# Relevance of key competences in CALL activities (an example from the author's e-course "English for Law" at http://el2.us.edu.pl/spnjo)

Example of activity	You be the judge
	SS split into groups, choose one case to consider by each group, study the facts of the case from the online service ybtj.gov.co.uk, then decide to role-play either the counsel for the defence or prosecution and consequently each group member prepares notes for their court battle and records their argument online; they can draw to other students' recordings

		and notes to prepare for the court battle in class.		
		SS can also find useful some quizzes, activities and materials accompanying the main activity, for example Quiz <i>Case collocations</i> Lesson <i>Trial</i> , Hot Potato Crossword <i>People in the Court</i> , etc.		
ICT involved		<i>Moodle:</i> Nanogong voice recorder, Nanogong online editor, Nanogong audio files, Chatroom, links to internet services, other Moodle functionalities.		
		Other: Java, Skype, headset and microphone.		
Key competence involved	Communicating in foreign language	Listening	~	SS watch and listen to case files; SS listen to other students' audio files.
		Reading	~	SS read facts of the case; SS read other students notes
		Writing (production)	~	SS write their notes
		Writing (interaction)	~	SS exchange information and ideas by means of chatroom
		Speaking (production)	~	SS record their talk
		Speaking (interaction)	~	SS interact in class and (or) talk to each other via Skype
	Digital competence		•	SS open interactive external online services, install and use Java, fix and use their headset and microphone properly, make the most of the online editor, instant messenger, chatroom, Skype and other Moodle functionalities.
	Learning to learn		~	SS manage their time, set their individual learning goals, motivate themselves (and each other), search for useful information, get enough individual extra language practice in order to deliver the task effectively; SS exchange information with other students and consult their tutor (and/or other SS).
	Social and civic competences		~	SS are aware of basic concepts relating to individuals, groups, gender equality, non-discrimination, society and culture; SS develop their sense of justice; SS communicate constructively in different environments; SS express and understand different viewpoints; SS show tolerance and are prepared to overcome prejudices and to compromise.
	Cultural		~	SS have an understanding of the cultural and linguistic
awareness and	diversity; SS work out ways of transferring their creative			
---------------	--			
expression	skills to a professional context			

Source: own work

The above mentioned activity is exemplified in Figure 1 below illustrating the teacher's perspective of the task. The component used (Nanogong Voices) offers many possibilities of application in the area of interaction: student  $\leftrightarrow$  teacher, student  $\leftrightarrow$  student(s), student  $\leftrightarrow$  tool.



Figure 1.Sample of the activity You be the judge from the e-course English for Law Source: http://el2.us.edu.pl/spnjo/mod/nanogong

## 2. EMPIRICAL STUDY

### 2.1 Stages of the Research

The area of developing key competences in academic teaching with the support of elearning requires empirical study. The author posed several research questions and embarked on research carried out in three stages, including a natural pedagogical experiment during the academic year 2011/2012 continuing in subsequent years. Table 2 shows how the research proceeded.

Т	ab	le	2.

	Stuges of	the author bresearch	
	Study of literature, reports,	Experience in e-learning	Experience in
is.	documents and results of	course authoring	conducting e-learning
lys	research on the use of e-	(General English courses	courses as part of
na	learning in language	A2 – B1)	university
Υ.	learning, graduates` level of		programmes
e 1	competences; analysis of		
tag	ICT tools (LMS systems)		
Ś	for CALL		

#### Stages of the author's research

Result:	Knowledge of theoretical background of the field of study; knowledge of how ICT tools work; knowledge of the teaching potential of e-learning techniques; formulating research problems.					
Stage 2. Preparation	Surveying the students' reflections on their development of language skills and other achievements and the suitability of using e- learning techniques (mid term survey).	Preparing and conducting an initial version of e-course "English for Law" for law students (ESP B2+). Surveying the students' opinions on the course and its effectiveness.	Experience in implementing competence-oriented tasks, their pedagogical assumptions and verifying their results.			
Result:	Formulating the initial line of research; preparation and verification of the research tool; posing research goals.					
Stage 3. Research	Continuing surveying students' reflections on their development of language skills and other achievements and the suitability of using e- learning techniques (final survey); 90 students surveyed.	Preparing an improved version of e-course <i>English for Law</i> for law students (ESP B2) with a survey on its effectiveness.	Preparation of the pedagogical experiment (pretest, posttest, group selection criteria, surveys, observation sheets, statistical tools, other); 100 students involved.			
Result:	Formulating research hypothe and controlling the process of of the hypotheses and formula lines of research.	esses; implementation of the esses; implementation of the esses; industry analysis of ating the conclusions; prepar	experiment; observing the results, verification ing further study and			

#### Source: own work

### 2.2 Aims and objectives

The main aim of the research was to develop empirically tried components of innovative methods of foreign language teaching with focus on developing language skills deciding the level of mastery of the second key competence. The methods include systematic use of e-learning techniques. Specific aims of the research included:

- determining the relation of conducting ELT classes as part of university programmes with the use of e-learning platform and Web 2.0 technology and the level of mastery of language skills indicating the level of the key competence of communicating in foreign languages;

- determining the importance of e-learning and Web 2.0 technology in designing a teaching process of competence-oriented university foreign language classes;

- indicating the relevance of conducting foreign language classes with the support of e-learning and Web 2.0 technology and the development of other key competences, such as learning to learn, digital, social, civic, cultural competences;

- establishing the relation between the learner's involvement and active participation in the e-learning course and the effectiveness of the development of communicative language competence.

On the practical side, the research aimed at developing an empirically verified elearning course aimed at increasing the effectiveness of the teaching process oriented on the development of key competences, as well as other components of the author's ELT system in terms of content, means, methods and forms of instruction. The structure of the e-course was designed according to methodological recommendations. It is hierarchical, module-based and consists of several standard blocks with content treated as the kernel of the course (Smyrnova-Trybulska 2009a, 2012). The course allows the learners to familiarise themselves with some essential areas of professional knowledge with focus on the use of language in context practised in action-based tasks. The students find opportunity to immerse into such topics as legal professions, cases, trials, courts, areas of law, torts, crime, punishment, contracts, business entities, employment, property, tax, constitution and human rights. It is important to note that in the course real communication and expression (set in the professional or semi-professional context) comes first before knowledge of specific legal terms as the freshers quickly come to realise it takes a long winding road to become a lawyer. With this in mind the course concentrates on developing various abilities requiring language skills such as arguing, responding to arguments, advising, analysing, searching for information, reporting, exchanging information, dealing with problems, finding consensus, paraphrasing, etc. The course addresses many real life problems or situations currently discussed and commented for the purpose of ensuring increased engagement on the part of the students and providing real language used in context thanks to internet and media coverage. Hence, reliance on internet sources is remarkable in the course.

### 2.2 Design and procedure

The experiment was conducted by the present author among a group of over 100 law students learning English for two semesters of their first year of studies at the University of Silesia in the academic year 2011/2012. The students shared a similar level of language competence confirmed by the results of the placement test (B2), the same syllabus which included an ESP component in the area of Legal English and using the Communicative Approach in teaching English as a foreign language. Besides, the admission criteria guaranteed a similar level of intellectual capacities. As part of the experiment the students did the same pretest at the beginning of the term. The test consisted of three parts representing the language skills measured: listening, reading and writing. Each part consisted of varied tasks aimed at bringing out the level of the abilities. The listening part consisted of three tasks requiring the ability of listening for gist, listening for detail and note taking. The reading part was

made up of two tasks testing reading for gist and reading for detail. The writing part involved writing a letter on the basis of necessary information and previous correspondence. The language was suited to the prospective working environment and the tasks involved some professional language required of somebody who wants to start a career in the legal or business profession. The types of tasks, however, represented the range of tasks the students were familiar with studying English in secondary school (multiple choice, true-false question, matching, gap filling, letter writing) so that the form did not hinder their performance. The results were statistically analysed and verified in order to check whether the students come from the same population. With almost normal distribution and equal variances (checked by means of Fisher's test) Student's t-test was applied and as a result the value of ttest of the experiment indicated the statistical insignificance of the difference between the arithmetic means of the results of each part of the pretest in both groups respectively. The result of the statistical analysis confirmed the homogeneity of two of the tested groups and consequently two research groups were selected: control group (27 students) and experimental group (28 students). The former was offered traditional instruction while the latter was taught with the use of a special innovative teaching system including an original e-learning course in legal English as an experimental variable. Both groups were run by the same teacher throughout the experiment. The teaching process was observed, monitored during the eight month period of the experiment, with numerous tests and a survey in both groups and finally the posttest was conducted. Again, the statistical analysis was carried out, which showed that the difference between the average results measured in the independent samples was statistically significant. The results of the experiment indicate that the change measured in the scope of the three skills after the eight months of the teaching process was bigger in the experimental group. The students in the experimental group outperformed the students in the control group in the progress made in the development of the three language skills. Also, statistical analysis was conducted in the dependent samples: EG and EC. The difference between the arithmetic means of the results of the pretest and the posttest proved to be statistically significant in both groups respectively.

#### 2.3 Results and findings

The language skill developed the most in the EG was writing (an increase of over 10%), while in the CG it was listening (with a 7.40% growth). In the EG the other two developed skills were listening and reading with a 9.75% and 7.75% increase respectively) while in the CG reading (5.87%) came second slightly before writing (5.75%). (Table 3)

The writing task was assessed on the basis of five criteria. Two of them represent linguistic competence: the extent of vocabulary and correct use of grammar. The score in these two criteria was separated for the purpose of analyzing the development of linguistic competence and statistical analysis based of Student's t-test showed there was a considerable advantage of the experiment group compared with the control group (Table 4).

### Table 3.

## Summary of the research results: comparison of arithmetic average differences between pretests and post-tests

		test results						
		Lg skills ranking in						
Language skills								Groups
	LISTENING READING WRITING							
	-	Points	Percentage	Points	Percentage	Points	Percentage	
	EG	1.95	9.75%	1.86	7.75%	2.07	10.35%	1. WRITING, 2. LISTENING, 3. READING
sdno.	CG	1.48	7.4%	1.41	5.87%	1.15	5.75%	1. LISTENING, 2. READING, 3. WRITING
Ō	Difference $\bar{d}_{EG} - \bar{d}_{CG}$	0.47	2.35%	0.45	1.88%	0.98	4.6%	1. WRITING, 2. LISTENING, 3. READING

#### Source: own work

#### Table 4.

## Summary of the research results: comparison of arithmetic average results in the scope of linguistic competence

	Difference between					
	1	arithmetic mean				
	points	percentage	points	percentage	$\bar{x}_{EG} - \bar{x}_{CG}$	
pretest	5.9	59%	5.74	57.4%	<mark>0.16</mark>	<mark>1.6</mark> %
postest	6.57	65.7%	5.78	57.8%	0.79	7.9%
Difference between arithmetic means of the pretest and posttest results $\overline{d} = \overline{x}_{\text{posttest}} - \overline{x}_{\text{pretest}}$	0.67	6.7%	0.04	0.4%		

#### Source: own work

The effect of statistical analysis was also confirmed in the experimental group students' own reflections on the development of particular language skills and the use of e-learning course supporting language learning. Their responses given in the survey conducted at the end of the course are summarised in Table 6.

Additionally, a correlation was found between the EG students' repeated, purposeful use of each module's teaching component (Moodle Lesson) and the score of the whole module. The calculated and verified Pearson's correlation coefficient for the whole course ( $r_{xy}$ =0,82) shows that the correlation between the students'

involvement and active participation in the e-learning course and the effectiveness of the development of language competence is considerable. (Figure 2)



Figure 2. Diagram illustrating a correlation between variables x and y in the EG

Source: own work

#### 2.4 Surveys

In respect of the development of other key competences the results of the survey conducted in both groups show that on average the students participating in the elearning course discern some progress in their ability to learn (in terms of time management, self-discipline, motivation and awareness of learning objectives) whereas the students from the control group think it is hard to say whether something has changed in this respect except for the ability to search information and use available resources. However, the students gave similar responses reflecting on their digital competence. They could not say exactly if there has been any change in their ability to use computer equipment as well as programs and services. What both groups differed in was being able to communicate by means of internet communication tools – the average response of the experimental group students was that they have noticed some change in this respect, whereas the students in the other group were not so certain about it. (Table 5)

As part of the research the experimental group was surveyed at the beginning and at the end of the experiment in order to find out whether they have experienced any influence of learning English with the use of ICT. In relation to the linguistic, sociolinguistic and pragmatic aspects of communicative language competence the students tend to notice some progress in their learning process supported by elearning in the area of grammatical, lexical and spelling correctness, appropriate use of styles, ability to make a speech, conduct a conversation or discussion, being coherent and recognizing diverse texts or messages. What the students emphasise was a considerably wide extent of vocabulary they could learn during the course, but they were not so sure whether there has been any change in their knowledge of correct pronunciation or rules of using appropriate language. (Table 6)

### Table 5.

## Summary of the survey on students' reflection on the progress in the development of selected key competences after one year of study



Source: own work

#### Table 6.

Summary of the survey of the EG students' reflection on the progress in the development of language competences after one year of e-learning course supported language learning.

E-learning course supported language learning helped me learn	l have noticed considerable progress	l have noticed some progress	Hard to say	l have noticed hardly any progress	l have not noticed any progress
	1	2	3	4	5
grammatical correctness		2,46			
lexical correctness		2,43	6		
correct spelling		2,11			
correct pronunciation		3	2,79		
an extended range of vocabulary	1,43				
how to use rules of appropriate language			2,56		
how to use different styles		2,32			
how to hold a speech, conversation or discussion		2,46			
how to reach logical and grammatical cohesion		2,39	6		
how to recognize the type and form of text or message		2,48		· · · · · ·	

#### Source: own work

Another reflection the students in the experimental group made was indicating the language skill they could experience progress in while studying: listening, reading and writing as well as interaction were the language activities the students sensed some progress in, they were not so certain in the case of speaking. (Table 7)

#### Table 7.

# Summary of the survey of the EG students' reflection on the progress in the development of language skills after one year of e-learning course supported language learning

E-learning course supported language learning helped me develop language skills in the scope of	l have noticed considerable	l have noticed some progress	Hard to say	l have noticed hardly any progress	l have not noticed any progress
	1	2	3	4	5
LISTENING: I listen to and understand somebody's talk, messages, instructions, radio and television broadcasts, recordings.		2.43			
READING: I read and understand correspondence, information, argumentation, instructions, I read for general understanding.		2.07	8		
SPEAKING: I express myself orally, describe my experiences and feelings, present my viewpoint, make a declaration, etc.			2.64		
WRITING: I express myself in a written form, write a text, letter, story, report, essay, study, description, etc.		2.11			
INTERACTION: I understand my partner, talk, take part in a formal and informal discussion, keep correspondence, take part in a chat, take notes, messages, forms, exchange information, hold a conversation for a specific purpose.		2.43			

Source: own work

The other aspect of the surveyed communicative language competence concerned language strategies used in effective communicating, of which planning was the strategy the students used to a considerable extent, and the strategies they used to some extent included using synonyms, correcting, inferring and interpreting, cooperating and engaging in interactions, processing texts. The two strategies they were uncertain about were asking for clarification and taking notes. Seemingly, the e-learning course did not create enough opportunity and need for using them (Table 8)

#### Table 8.

Summary of the survey of the EG students' reflection on the progress in the effective use of language strategies during their experience with e-learning course supported language learning *Source: own work* 

E-learning course supported language learning made me	To a considerable extent	To some extent	Hard to say	Hardly ever	Never
	1 1	2	3	4	5
plan what I wrote or talked about	1,48			3	3
replace words or phrases with synonyms		1,86			
care for correctness and correct my talk or text	8 - 6	1,54		3	8
infer or interpret meanings	a	1,75			
ask for clarification			2,61		
cooperate and engage in interactions		2,4		0	
process text		1,86			
take notes			2,79		

Additionally, the repeated surveys allowed to establish which organisational forms of e-learning supported language learning are most effective. The e-course was given 4 out of 5 in terms of being easy to use and student-friendly. The components the students found very useful were lessons, quizzes (including audio/video quizzes), crosswords and games, editing glossary, webquests, written assignments (4/5). Those whose usability was marked 3 out of 5 included oral assignments (Nanogong Voices), forum and chat. The area of organisational forms is undergoing rapid technological change and improvement and it certainly deserves further research.

#### 2.4 Discussion

Having analysed the results of the empirical study it is possible to conclude that supporting the teaching process with appropriate e-learning techniques and Web tools influences positively the development of language skills, and consequently favours the development of the key competence of communicating in foreign languages. The language skill developed the most was writing. The other two skills were listening and reading. These findings are reflected by the students' responses in the survey. Apart from the considerable increase noted in the development of the three language skills, linguistic competence can be maximised when its development is supported by e-learning techniques. One element of this competence: extent of vocabulary was particularly emphasised by the survey respondents. Parallel development was also observed in the case of other key competences, such as digital competence, learning to learn, social and civic competence and cultural awareness and expression.

## CONCLUSION

In light of the above-mentioned research there is enough ground for ascertaining that supporting foreign language learning with e-learning techniques considerably improves the development of communicative language competence, which manifests itself in the mastery of language skills as well as strictly linguistic aspects of the competence (extent of vocabulary and grammatical correctness) being the exponents of the key competence of communicating in foreign language. The positive results in this respect mark the influence e-learning has on the development of this key competence as well as other key competences. The effectiveness in this respect is enhanced by appropriately selected, methodologically justified methods and techniques of education including the application of e-learning platforms, the use of which is received by students positively within the practice of academic foreign language teaching. It is important to note that using one comprehensive tool such as Moodle allows to maximise the competence-oriented foreign language learning and teaching, which definitely favours lifelong learning.

#### REFERENCES

- Bax, S., 2003: CALL past, present and future. System, 31, 2003, pp.13-28.
- Gadomska, A., Krajka, J., 2012: Developing Social and Civic Competences as Aspects of Intercultural Communicative Competence – E-learning for Middle School Students – A Case Study. In: Smyrnova-Trybulska, E. (ed.), E-learning for Societal Needs: Monograph. Cieszyn, Katowice: Studio Noa, p. 106-113. ISBN 978-83-60071-59-5.
- Huk, T., 2008: *The computer in the process of developing key abilities*, Difin, Warszawa 2008, p. 30,31. ISBN: 927-88-37251-925-2. [In Polish]
- Kalamarz, R., 2010: Practical Applications of LCMS Moodle in University Foreign Language Teaching. In: Smyrnova-Trybulska, E. (ed.), Use of Elearning in the training of professionals in the knowledge society: monograph, Studio Noa, Cieszyn, Katowice, 2010, p. 241-246. ISBN 978-83-60071-30-4.
- Kalamarz, R., 2011: Gearing E-learning for the Development of Communication in Foreign Languages as a Key Competence. In: Smyrnova-Trybulska, E. (ed.), Use of E-learning in the Developing of the Key Competences: monograph. Studio Noa, Cieszyn, Katowice, 2011, p. 451-462. ISBN 978-83-60071-39-7.
- Kalamarz, R., 2012: Maximising Key Competences in Foreign Language Classes. E-learning in the Development of the Competence of Communication in Foreign Languages. In: Smyrnova-Trybulska, E. (ed.), E-learning for Societal Needs: monograph. Studio Noa Cieszyn, Katowice, 2012, p. 457-468. ISBN 978-83-60071-59-5.
- Kossakowska-Pisarek, S., 2009: *The constructivist qualities of distance learning techniques as illustrated by a blended learning Moodle course*. L. Rudak (ed.), Selected issues on e-education, Wydawnictwa Naukowo-Techniczne, Warszawa 2009, p. 102-108. ISBN 978-83-204-3534. [In Polish]
- Krajka, J., 2007: English Language Teaching in the Internet Assisted Environment: issues in the use of the web as a teaching medium, Maria Curie-Skłodowska University Press, Lublin, 2007, p.225. ISBN 978-83-2272-726-3.
- Krajka, J., 2012: The Language Teacher in the Digital Age Towards a Systematic Approach to Digital Teacher Development. Lublin: Maria Curie-Skłodowska University Press, p.19-52. ISBN 978-83-7784-131-0.
- Marszałek, A.: Common taxonomy of competences and vocations as an instrument supporting the functioning of systems of education and labour markets. Ementor no. 3(35), 2010, available at http://www.e-mentor.edu.pl/ artykul/index/numer/35/id/760 (accessed on 1 June 2013). [In Polish]
- Osiński, Z.: *In search of effective methods of academic teaching*. E-mentor no. 2(34), 2010, available at http://www.e-mentor.edu.pl/artykul/index/numer/34/id/729 (accessed on 1 June 2013). [In Polish]

- Piasecka, M., 2009: Foreign language teaching and the quality of academic education. In: Komorowska, H. (ed), Language learning in higher education. Wydawnictwo SWPS "Academica" Warszawa, 2009, p.122. ISBN: 9788389281777. [In Polish]
- Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning (2006/962/EC), available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:394: 0010:0018:EN (accessed on 1 June 2013).
- Sharma, P., Barrett, B., 2007: Blended Learning. Using technology in and beyond the language classroom. Macmillan Books for Teachers, London, 2007. ISBN: 978-0-230-02083-2.
- Smyrnova-Trybulska, E., 2009: On some methodological and information aspects of foreign language teaching in remote mode, paper from the 19th National Scientific Symposium "Komputer w edukacji" Kraków, 25-26 September 2009 available at http://www.up.krakow.pl/ktime/ref2009 /smyrnov.pdf (accessed on 1 June 2013) [In Polish]
- Smyrnova-Trybulska, E., 2009: On some psychological, pedagogical and organizational aspects of communication in a virtual team. In: Musioł, A. (ed.), Communication and quality of life. The prospect of teaching. A collection of scholarly papers. State Higher Vocational School in Raciborz, Raciborz, 2009, p.54-66. [In Polish]
- Smyrnova-Trybulska, E., Stach, S. (ed.), 2012: Using LCMS Moodle as a system for distance learning support. Studio Noa, Katowice, 2012, p.82-97. ISBN 978-83-670071-56-4. [In Polish]
- Szerląg, A., 2009: Expectations towards the university graduate as the subject of education.. In: Szeląg A. (ed), *Competences of present-day university* graduates. Selected aspects, Oficyna Wydawnicza Atut, Wrocław, 2009. ISBN 978-83-7432-532-5. [In Polish]
- Warell, H., 2013: *Universities face online avalanche*, available at: http://www.ft.com/cms/s/0/704c2158-880d-11e2-b011-00144feabdc0.html (accessed on 1 June 2013).

## EXPLORING THE IMPACT OF TWO DIFFERING BLENDED LEARNING PROCEDURES ON TEACHING ENGLISH FOR SPECIFIC PURPOSES

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**Abstract:** The paper reports the results of the quasi-experiment conducted in a group of intermediate adult ESL learners, studying international relations at the University of Cardinal Wyszynski in Warsaw in the 2011-2012 academic year. It employed both pre-and posttreatment tests, experimental and control groups, but no random assignment of subjects. Its objective was to compare the impact of two blended learning procedures on teaching English for Specific Purposes. IBM SPPS Statistics 20.0 was employed to conduct the preliminary processing of the collected data and their analysis.

**Keywords:** English for Specific Purposes, blended learning, vocabulary acquisition, receptive/productive vocabulary knowledge, quasi-experiment

## **INTRODUCTION**

The article presents research findings related to vocabulary acquisition in English for Specific Purposes (ESP). In recent years, after decades of neglect, vocabulary has become central in the process of foreign language acquisition, native or non-native (Laufer 1997; Nation 2001). It is now not only understood that without the extensive use of vocabulary, learners are unable to develop structures indispensable for communication in a given language. It also goes without saying that vocabulary errors are considered to be more disruptive and more likely to hinder real life communication than grammatical errors. Consequently, the priority of lexis over grammar is underlined by many eminent specialists in the area of Foreign Language Teaching (FLT) (Lewis 1993 in Piasecka 2001; Komorowska 2005) since it is generally understood that to be able to produce and recognize sentences, learners require good lexical skills.

The need to develop lexical competences for both general and specific purposes is undisputed nowadays. It seems to arise out of the growing significance of foreign languages in general, and English as the contemporary *lingua franca* in particular, the expansion of today's world's space, the rising amount of business and social contact and our increasing mobility. The constant changes typical of the contemporary world require appropriate teaching procedures of foreign language lexis. They should be adopted to the specific needs of the target learners, when teaching a foreign language for both general and specific purposes. This is all the more so that vocabulary acquisition is a lengthy process, and lexical competence involves the ability to understand and produce the spoken and/or written word and to understand its meaning. Accordingly, it seems worthwhile exploring the impact of different study conditions on learners' vocabulary expansion and the resultant progress in the area of receptive and productive vocabulary.

## 1. RESEARCH BACKGROUND

The objective of the quasi-experiment presented here was to explore the impact of two differing blended learning procedures on ESP vocabulary acquisition, and more specifically on the selected aspect of English for Academic Purposes (EAP). The study of languages for specific purposes has had a long and eventful history and goes back, some would say, to the times of the Roman and Greek Empires (Duddley-Evans, St. John 2009). Since the 1960s, ESP has become a significant and innovative activity within the Teaching of English as a Foreign or Second Language (TEFL/TESL) movement (Howatt 1984 in Duddley-Evans, St. John 2009). Much of its early life was dominated by EAP teaching and research carried out in the area, e.g. English for Science and Technology (Swales, 1988 in Duddley-Evans, St. John 2009). The massive expansion of international business observed in recent years has led to an enormous growth in the area of English for Business Purposes (EBP), which is also the largest sector for published materials. Currently, ESP teaching takes place in a series of differing contexts and ESP teaching practitioners often find themselves dealing with content in an occupation or subject of study which they themselves have very little or no prior knowledge of, e.g. English for law studies, English for the health care, English for nursing, English for the hospitality industry, to name but a few (Basturkman 2010). Empirical investigation into the effectiveness of ESP teaching is limited (Duddley-Evans, St. John 2009), and mainly restricted to EAP (Basturkman 2010). To the best of my knowledge, no study explored the impact of two differing blended learning procedures on vocabulary acquisition in EAP.

## 2. KEY RESEARCH CATEGORIES

The term *blended learning* originated in the business world in connection with corporate training (Sharma, Barrett 2007 in Whittaker 2013a) to become employed in tertiary education (MacDonald 2006 in Whittaker 2013a), and finally to appear in language teaching and learning. According to C. Whittaker

(2013a), the term became commonplace in English Language Teaching (ELT) in 2007, with the publication of P. Sharma and B. Barrett's book *Blended Learning*. Its definition, however, poses a few problems. Though practitioners generally agree that this teaching procedure refers to the inclusion of computer technology to provide a combination of online and offline activities and materials in the mix (cf. Whittaker 2013a), they tend to disagree about the percentage of each element in the blend. a literature review, it becomes apparent that blended Thus when conducting learning can mean different things to different people (cf. Whittaker 2013a). Therefore for the purpose of the experiment presented here, I define it as any combination of face-to-face, computer and self-study modes (after Whittaker 2013b). Depending on the group taking part in this quasi-experiment, the lead mode was different. In the control group, the lead mode was face-to-face, whereas in the experimental group it was the computer mode. After the presentation of the core materials and a series of initial exercises in the face-to-face mode, each group continued lexical practice employing its lead mode and self-study mode. The proportions of the blend typical of each group are described in the next section.

**English for Academic Purposes (EAP)** is – next to English for Occupational Purposes (EOP) – one of two main strands of English for Specific Purposes (ESP) (Dudley-Evans, St. John 2009). It can be further divided according to the field of study, e.g. English for Science and Technology (EST), English for Medical Purposes (EMP), English for Legal Purposes (ELP) or English for International Relations (EIR), etc. EAP training programmes are designed for students and focus on skills required in an English-speaking academic context across core subject areas generally encountered in a university setting.

Such language training programmes can base their material on a number of speech acts or functions (Jordan 2006; Basturkman 2006). They might as well take into consideration the selected skill areas (Jordan 2006), e.g. vocabulary. Technical **vocabulary**, which was the focus of this experiment, is defined as part of a system of subject knowledge of a particular area; as such it can be identified by referring to specialists who have a good knowledge of the subject area (Chung, Nation 2004). Accordingly, as T. Dudley-Evans and M. St. John (2009) phrase it, it is general English words that have a specific meaning in certain disciplines. The teaching of vocabulary in EAP generally follows principles similar to those in English for General Purposes (EGP). Thus it is advisable that individual words be taught in natural contexts. These show how the words function and allow learners to make intelligent guesses of meaning. It is also important to encourage individual learners to employ strategies that work best for them and facilitate cognitive processing. To aid the retrieval of vocabulary items, it is advisable to use situational and semantic sets, metaphors, collocations, corpora and learning language chunks (Dudley-Evans, St. John 2009).

Since learners usually know more words than they use, it is customary to distinguish between **receptive** and **productive vocabulary knowledge**. The category of receptive vocabulary refers to lexical items that are recognized in speech or writing, whereas productive vocabulary includes words that are used to form utterances.

## 3. RESEARCH HYPOTHESES

The objective of the experiment was to explore the impact of two differing blended learning procedures on EAP. The selected aspect of EAP was defined as the British political system versus the American political system, and their institutions.

The experiment was designed to collect data in the areas of receptive and productive acquisition of technical terminology. IBM SPPS Statistics 20.0 was employed to conduct the preliminary processing of the collected data and their analysis.

Since the data collected in the respondent group did not prove to be normally distributed and the experimental group slightly outnumbered the control group, the Mann-Whitney U Test, a non-parametric equivalent of the Independent T-Test, was employed to analyze the results of vocabulary acquisition from two independent groups with different study conditions (cf. Bedyńska, Cypryańska 2013). In keeping with the assumptions of the test, two hypotheses were formulated. The null hypothesis for the experiment ( $H_0$ ) states that the score means of the students from the control and experimental groups are equal. The alternative hypothesis ( $H_1$ ) assumes that the score means of the students from the control and experimental groups are not equal. Accordingly, different study conditions represent the independent variable (in the case of the control group – face-to-face lead mode and for the experimental group – the computer lead mode) and the posttreatment test scores of the students – the dependent variable.

The alpha level ( $\alpha$ ) was established at 0.01, which is typical of language studies and suggests that only 1 per cent of the results obtained are due to chance. Based on the test statistics, the received *p* value is to be compared with the assumed level of significance  $\alpha$ . If  $p \le \alpha$ , H<sub>0</sub> is rejected and H<sub>1</sub> is accepted, whereas if  $p > \alpha$ , there is no reason to reject H<sub>0</sub>.

## 4. METHOD

## 4.1. Subjects

The experiment was conducted with a group of 113 intermediate adult learners studying EFL at the University of Cardinal Stefan Wyszynski in Warsaw in the academic year 2011-2012. The selection of the students followed a non-probabilistic sampling strategy referred to as convenience or opportunity sampling (Dörnyei 2011). All the subjects studied in the researcher's own institution and possessed two key characteristics related to the objective of the experiment: they qualified for the

B1+ level of proficiency in EGP and studied international relations at the Faculty of Law and Administration. The respondents came from 2 first-year and 2 second-year student groups. Their level of proficiency in EAP was measured on a test with a maximum score of 40 points. Both groups had the same teacher.

## 4.2. Instrumentation

To investigate the impact of two differing blended learning procedures on the acquisition of EAP vocabulary, the quasi-experimental research design was employed. It had both pre- and posttests, experimental and control groups, but no random assignment of subjects (Nunan 2004). Before the experiment, both groups were provided with pretreatment tests meant to assess their knowledge of technical vocabulary. The test had two parts: receptive and productive. The former involved a matching task in which subjects were requested to match 20 English vocabulary items with their Polish equivalents. The latter consisted of 19 English sentences in which 20 words were blanked. Students were required to supply the missing words, drawing on the number of blanks, each of which corresponded to one word letter, and on one letter that was provided for each word in one of the blanks. After the treatment, the groups received the same two-part posttests. The maximum score on the pre-/posttest was 40 points, 20 points for each part of the test.

Two differing blended learning procedures applied in the experiment refer to disparate study conditions. Both were designed for eighteen-lesson-unit instruction (with each lesson unit lasting 45 minutes) and contained the same five elements:

- face-to-face material presentation;
- face-to-face exercises;
- computer activities and/or exercises;
- self-study;
- pre- and posttest.

Yet depending on the group, the proportion of some elements varied, influencing its lead mode. The lead mode employed in the control group is referred to as the face-to-face mode since the blended learning procedure employed in the group had more face-to-face exercises and fewer computer activities. The blended learning procedure employed in the experimental group, here referred to as the computer mode, consisted of fewer face-to-face exercises and more computer activities and/or exercises. The core materials in both groups were presented and initially practised in the face-to-face mode (4 lesson units). Following that, the control group – working under the teacher's supervision, spent 7 lesson units doing pencil and paper exercises and topic related activities in class while 2 lesson units of their time were devoted to computer activities. In the experimental group, the time devoted to pencil

and paper exercises and other topic related activities was limited to 2 lesson units, whereas computer activities and/exercises were designed for 7 lesson units. In addition to that, it was assumed that students in both groups devoted about 3 lesson units to self-study. It took two lesson units to administer the pretreatment and posttreatment tests (cf. Figure 1).



Figure 1. Activities and exercises employed in the control and experimental groups

#### Source: own

Exercises conducted in the face-to-face mode, computer mode and self-study mode supplemented the syllabus and provided the students with controlled practice and extension activities, giving them the opportunity to review and recycle in the group lead mode all that was presented in the face-to-face mode. As regards the materials used at the face-to-face presentation phase, a blend of customized reading comprehension texts were employed in both groups. The texts were based on the selected chapters from the following textbooks: *Lexical Compendium: Politics* by K.A. Luto and M. Ganczar (2007) and *Aspects of Britain and the USA* by C. Garwood, G. Gardani and E. Peris (1994). In addition to that, short YouTube videos (the British Constitution, six principles of the US Constitution) followed by comprehension questions were shown to the students. Both groups had these materials embedded on an open-source e-learning platform MOODLE (UKSW, 2011) and could refer to them while learning.

In contrast to the control group, the experimental group had a series of follow-up exercises embedded on the platform. These learning assignments included interactive comprehension quizzes to YouTube videos mentioned above as well as vocabulary exercises (such as crosswords, matching tasks, gap-filling exercises, quizzes, jumbled words and sentences) created for the purpose of the experiment with the help of the free lesson construction software *Hot Potatoes* Version 6. The

control group had access to the same activities, but in the face-to-face mode. The lexical material thus presented was also consolidated in the form of mini presentations (e.g. basic principles of the British/American Constitution, British/American Legislature, Executive, Judiciary) prepared by the students in the self-study and face-to-face modes. The former mode also involved consolidation exercises from *Lexical Compendium: Politics* by K.A. Luto and M. Ganczar (2007) and referring to the materials embedded on the platform.

## 4.3. Procedures

Attempting to explore the impact of two differing blended learning arrangement of activities on EAP vocabulary acquisition, the following procedure was employed:

- 1. The pretest to collect data on the subjects' pretreatment knowledge of technical terminology;
- 2. Deciding on the control group and the experimental one;
- 3. The presentation of technical terminology in the face-to-face mode in both groups;
- 4. Follow-up exercises and activities in the lead mode of the group and selfstudy mode;
- 5. Mini presentations prepared by the students in the self-study and face-to-face modes;
- 6. The posttreatment test to collect data on the subjects' posttreatment knowledge of technical terminology;
- 7. Employing the Mann-Whitney U Test to analyze the pre- and posttest scores of the subjects acquiring technical terminology in different study conditions.

## 5. RESULTS

The results obtained in the course of the experiment show that the experimental group performed better on the receptive part of the pretest (M = 6.53; SD = 2.73 for the experimental group and M = 4.96; SD = 2.25 for the control group), only slightly outdoing the control group on the productive part of the pretreatment test (M = 0.05; SD = 0.22 for the experimental group and M = 0.00; SD = 0.00 for the control group). Running the Mann-Whitney U Test shows that at the pretreatment phase of the experiment, the differences between the groups are statistically significant only for the receptive aspect of vocabulary knowledge (U = 979.500; Z = -3.576; p < 0.01), and not for the productive aspect (U = 1512.500; Z = -1.702; p > 0.01). In the former case, it is thus possible to accept the alternative hypothesis implying statistically significant differences between the groups on the pretreatment reception

test, whereas in the latter – the null hypothesis about the lack of such differences on the production pretest is to be accepted.

At the posttest phase, the experimental group slightly differed from the control group on the receptive part of the test (M = 17.95; SD = 2.23 for the experimental group and M = 17.75; SD = 2.55 for the control group). When it comes to the productive part of the posttreatment test, the control group outdid the students in the experimental group (M = 13.09; SD = 4,66 for the control group and M = 8.03; SD = 4.13 for the experimental group). When the Mann-Whitney U Test is run, it shows that at the posttreatment phase of the experiment the differences between the groups are statistically significant only for the productive aspect of vocabulary acquisition (U = 691.500; Z = -5.201; p < 0.01). Drawing on the results obtained, it is possible to accept the alternative hypothesis about differences in score means between the groups in the area of productive vocabulary acquisition. As far as the receptive aspect of technical vocabulary acquisition is concerned, the test results show that the differences between the groups are not statistically significant (U = 1564; Z = -0.182; p > 0.01). Thus for this aspect of vocabulary acquisition, the null hypothesis about no differences in score means between the groups must be accepted.

The results presented above show that before the experiment, the experimental group (the computer lead mode) outdid the control group (face-to-face lead mode) in the area of receptive knowledge of technical terminology. As far as the productive aspect of vocabulary knowledge is concerned, the groups manifested statistically insignificant differences at the pretreatment stage. The results obtained for the posttreatment phase do not display statistically relevant differences in the area of receptive vocabulary acquisition, which seems to testify to the fact that both blending learning procedures employed were equally conducive to the expansion of receptive knowledge of technical vocabulary. Since after the experiment we can observe statistically significant differences in the advantage of the control group, it must be concluded that the face-to-face mode accounted for the progress in the productive acquisition of technical terminology.

## 6. CONCLUSION

The results of the experiment presented in this article are to be viewed with caution and treated as suggestive rather than definite for several reasons. The most important of them relates to the reliance on convenience or opportunity sampling to select the target population meeting certain practical criteria pertinent to the objective of the study. This sampling strategy makes general relevance of the experiment findings less significant since the extent of generalizability of this type of sample is rather negligible.

The results of the experiment do not seem to run contrary to common sense predictions and thus by no means appear surprising. They testify to the fact that two

differing blended learning procedures proved to be equally conducive to the receptive acquisition of EAP terminology. Accordingly, it can be concluded that irrespective of the lead mode of the group, the students participating in the experiment successfully acquired EAP vocabulary receptively. On the other hand, the productive expansion of technical terminology was more problematic for the group employing the computer lead mode. This might, for example, imply some individual differences between the groups, one of them being the lack of learner appropriate strategies of vocabulary learning and retrieval in the experimental group.

It seems that more experimental studies are needed to explore the impact of various blends of online and offline activities on vocabulary acquisition, in both EGP and EAP. It also appears advisable that these research designs rely on probability sampling and incorporate, if necessary, lexical strategy training thus making the online component of the blend more tailored to the learner needs. As yet, a first tentative attempt at explaining the impact of two differing blended learning procedures on EAP vocabulary acquisition has been made.

## REFERENCES

- Basturkman, H., 2006: *Ideas and Options in English for Specific Purposes*. Lawrence Erlbaum Associates, Mahwah, 2006, pp. 186. ISBN: 080584418X.
- Basturkman, H., 2010: *Developing Courses in English for Specific Purposes*. Palgrave Macmillan, New York, 2010, pp. 157. ISBN: 9780230227989.
- Bedyńska, S., Cypryańska, M. (eds.), 2013: Statistical Guide 1: Practical Introduction to Statistical Inferencing. Academic Publishing House 'Sedno' and University of Social Sciences and Humanities, Warsaw, 2013, pp. 297. ISBN: 9788363354350 [In Polish].
- Chung, T.M., Nation, P., 2004: *Identifying Technical Vocabulary*, available at https://www.victoria.ac.nz/lals/about/staff/publications/paul-nation/2004-Chung-Identifying-Tech-Voc.pdf, (accessed on 31 July 2013).
- Dörnyei, Z., 2011: Research Methods in Applied Linguistics. OUP, Oxfords, 2011, pp. 336. ISBN: 9780194422581.
- Duddley-Evans, T., St John, M.J., 2009: Developments in English for Specific Purposes: A Multi-disciplinary Approach. CUP, Cambridge, 2009, pp.301. ISBN: 9780521596756
- Garwood, C., Gardani, G., Peris, E., 1994: Aspects of Britain and the USA. OUP, Oxford, 1994, pp. 95. ISBN: 9780194542456
- Jordan, R.R., 2006: English for Academic Purposes: A Guide and Resource Book for Teachers. CUP, Cambridge, 2006, pp. 411. ISBN: 052155618X

- Komorowska, H., 2005: *Methodology of Foreign Language Teaching*. Fraszka Edukacyjna, Warszawa, pp. 204. ISBN: 978838883945 [In Polish].
- Laufer, B., 1997: What's in a word that makes it hard or easy? Some intralexical factors that affect the learning of words. Vocabulary: Description, Acquisition and Pedagogy. CUP, Cambridge, 1997, pp. 383. ISBN 9780521585514.
- Luto, K.A., Ganczar, M., 2007: Lexical Compendium: Politics. Poltext, Warszawa, 2007, 157. ISBN: 9788388840951.
- Nation, I.S.P., 2001: Learning Vocabulary In Another Language. CUP, Cambridge, 2001, pp. 492. ISBN: 978 0521804981.
- Nunan, D., 2004: *Research Methods in Language Learning*. CUP, Cambridge, 2004, pp. 249. ISBN: 0521429684.
- Piasecka, L., 2001: Ways with Words: Strategies of Lexical Acquisition. Uniwersytet Opolski: Opole, 2001, pp. 179. ISBN: 8388796291.
- Schmitt, N., McCarthy, M., (eds.), 1997: Vocabulary: Description, Acquisition and Pedagogy. CUP, Cambridge, 1997, pp. 383. ISBN: 9780521585514.
- Tomlinson, B., Whittaker, C., (eds.), 2013: Blended Learning in English Language Teaching: Course Design and Implementation. British Council, London, 2013, pp. 258. ISBN: 978-0-86355-706-4. Also available at http://englishagenda.britishcouncil.org/sites/ec/files/D057\_Blended%20learnin g\_FINAL\_WEB%20 ONLY\_v2.pdf (accessed on 31 July 2013).
- Whittaker, C., 2013a: Introduction. Blended Learning in English Language Teaching: Course Design and Implementation. British Council, London, 2013, pp. 258. ISBN: 978-0-86355-706-4
- Whittaker, C., 2013b: A military blend. Blended Learning in English Language Teaching: Course Design and Implementation. British Council, London, 2013, pp. 258. ISBN: 978-0-86355-706-4

## THE INFLUENCE OF SENSORY PERCEPTIONS OF BLENDED LEARNING LANGUAGE COURSE PARTICIPANTS ON THE ACQUISITION OF ENGLISH

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Abstract: For almost 20 years polish universities have been introducing more and more classes based on educational platforms. Such classes are conducted in different forms, as fully distance (e-learning), joining traditional meeting with online learning (blended learning) or as supporting traditional process of education, by for example placing exercises on the platform, test that allow self-evaluation. The richness of materials available within the www network encourages teachers to create a flow of educational process on the base of different multimedia and reaching for methods and forms of classes not previously used. Especially interesting is in such a situation the use of blended learning which is considered the most effective form of distance learning mainly due to the fact that it allows: keeping direct interpersonal relationships during classes, individualisation of the learning process and taking into account learners' different sensory perceptions. This article presents some research results conducted among students learning English in a blended learning form. Authors will try answer the question whether while classes conducted in this form sensory perceptions and the used method influence getting knowledge and its permanence.

**Keywords:** language education, sensory preferences, blended learning, educational platform

## 1. INTRODUCTION

The knowledge of foreign languages, including most of all the dominating English language, is currently a necessity. According to the norms of European Union each its citizen should i.a. be able to communicate in a native language as well as foreign languages (see. *Key Competencies in lifelong learning – European Framework of* 

*Reference*, 2006, L 394/13). It means that each citizen should be able to use the language system (code) at three levels: phonological, morphological and syntactic. The system, which each language is, is a set of signs and a cluster of grammatical rules which allow using simple signs to build complex ones that is grammatically correct sentences.

Language education is obligatory since primary school; it becomes one of the most important elements of the educational system of young people. Higher schools also pay more and more attention to language education by seeking other solutions that allow effective education i.e. assuming acquisition of new contents, knowledge, and development of new skills as well as the change in the attitude of the learners.

By seeking new optimal and involving methods of language education teachers more and more often start to use forms not really known before, such as blended learning. Such a choice is not accidental because this form of education joins the advantages of both traditional and distance education (Table 1).

### Table 1.

Blended learning	
advantages of traditional education	advantages of e-learning
possibility to be in a direct contact with the participants of the process of education (other students, teacher)	possibility of individualised education, fitted to the needs and learners' possibilities
immediate possibility to exchange opinions, ideas, thoughts with other participants of the process of education	ability to match time and place of learning to the needs and possibilities of the learner
possibility of having practice – conducting own experiences, experiments and other activities connected with the subject	ability to prepare and use of multimedia educational materials in an unrestricted scope
a reliable form of controlling learning progress	ability to go back to the previously learned contents and revising them

## Advantages of blended learning

Source: authors' source

At this stage it is worth wondering how to define blended learning? In the literature (Sharma, 2010) points to three definitions:

- (1) a combination of face-to-face and online teaching;
- (2) a combination of technologies;
- (3) a combination of methodologies.

The authors of the article will use the first definition in which 'traditional learning' is classroom teaching or 'face-to-face' language lessons. The delivery of the online

part of the course is usually through learning technologies, typically involving a Virtual Learning Environment (VLE) such as 'Blackboard' or 'Moodle' and comprising the use of synchronous and asynchronous electronic tools, such as, respectively, 'chat' and 'bulletin boards' (Sharma 2010: 456).

According to these assumptions in the years 2007-2010 blended learning programmes for both studying full - and part-time students were prepared. The described research was conducted in the academic year 2012/2013. The survey involved 10 language groups, 135 students of both sexes altogether, aged 19 to 25 years. Control group counted 68 students in total and experimental group 67 students in total.



Figure 1. Example of the module contents

Source: Blended learning course completed at University of Economy in Bydgoszcz

Blended learning programme included traditionally conducted classes that took place at the schools' premises and were conducted by an English language teacher on the base of a course book chosen for the level and profile of education. Traditional part involved the development of speaking, writing and listening skills. Online part took place on the educational platform Moodle where students could find language courses suitable for the level of the group and the chosen course book. Materials placed on the platform were thematically connected with the currently completed contents of the course book and referred to grammar, vocabulary and allowed development of the skill of reading with understanding. The students could also access other different resources. (Figure 1.)

In this part of the module you will practice names of countries and nationalities.



Before you start solving the crossword puzzle, revise vocabulary connected with countries and nationalities which is available in your course book p. 6.

Complete the crossword puzzle, when you click on the first letter in each line vertical or horizontal the clue will appear.

You can do the quiz as many times as you wish. The highest score will be recorded. You can get a maximum of 9 points.



**Figure 2. Crossword puzzle for Module 1, Quiz 4 – Nationalities** Source: Blended learning course completed at University of Economy in Bydgoszcz

All students who took part in the research used the same resources placed on the platform; these resources were prepared not only in a text version (very often supplemented by statistical graphics) but also included audio and video materials. There were also exercises requiring certain activity, based on playing, such as: solving crossword puzzles (Figure 2.), activities where students had to match some elements (text to text, text to a picture). This diversity was not accidental as while course design different learners' sensory perceptions were taken into account.

Students from control group were working face-to-face only meeting their teacher once a week for 90 minutes. Experimental group also had face-to-face classes once a week (90minutes), but between face-to-face meetings they had access to platform tasks which they had to complete between face-to-face meetings, but could access them as many times as they wished and spend on the platform as much time as they wanted.

## 2. HUMAN SENSORY SYSTEM

The supporters of Neuro-Linguistic Programming introduced division into different sensory perceptions that involve preferences such as: visual, auditory and kinaesthetic. There are however neither no scientific proves that these influence learning, nor that the preference in one sphere leads to success in language learning. Actually it is difficult to separate learning style from other factors such as personality, intelligence, previous experience in learning; all of these may influence the process of learning. It is not also clear to what extend learning style can be manipulated by for example learner training. If the preferred style of a learner does not follow the type of instruction given then being successful is less probable than if the factors were matched (Thornbury 2006). Kinaesthetic students act differently when they deal with Internet based learning than visuals. Visuals like shows so they will prefer Internet as a source of knowledge in contrast to kinaesthetic students who learn through acting.

Sensory system is a part of our personal, specific neuro-linguistic wiring. The basic, automatically triggered preferred sense, which is the way in which we perceive and react to information given by visual, auditory or kinaesthetic channel. This way decided about the way in which perceive the world, type of information we remember and perceive, so the way we create our own representation of the world. This style determines our persona; learning strategy and the way we communicate with other people. The preferred sensory system makes it difficult for us to learn something which is presented in a representing system different than the one preferred by us. It can also be thought that communication with other people is annoying. The preferred sensory system according to M. Taraszkiewicz has influence on grades received by the learners, both for oral and written tasks. The preferred sensory system corresponds with grades in such disciplines as: tidiness in making notes, nice handwriting, and politeness measured by personal appearance, tidiness and careful listening. The winners are visuals; the ones that suffer the most

are kinaesthetic students. Those learners whose sensory system corresponds with the sensory system of the teacher are in the best situation (Silberman 2005).

## 2.1. Categories of learners according to the preferred sensory system

## 2.1.1. Visual

Their preferred sensory channel is visual channel. They like to learn by looking, observing, they like presentations, charts, diagrams, organized texts. They like descriptions, remember face well, forget the names, like to make notes, their thoughts are formed in pictures that is why very often what they say is chaotic, they think about several things at the same time. Typical visuals do not like to speak a lot, when they speak however they use high pitches of voice, speak loudly, fast. They very often have so called 'artistic intelligence'.

## 2.1.2. Auditory

They like to speak a lot and listen to others. In books they avoid descriptions and pictures, they repeat loudly what they wrote, they forget names, remember names, learn through loud repetition of information, prefer music to visual arts, have problems with maps and graphs. Visuals speak at a medium pitch, not very fast, very often while listening they move their heads, often prick up their ears. Typical auditory students have 'musical intelligence', they hear the world.

## 2.1.3. Kinaesthetic

Kinaesthetic students like to feel emotions, movement, taste and smell. They do not like reading, have problems with spelling. They remember best what they have done themselves, they need to move, they like to keep something in their hands, use gestures and like close contact while talking to someone. They learn by doing and direct involvement. They speak slowly at a low pitch.

It seems that there are no clear types, generally people represent mixed types with dominating one and by observing their behaviour, and used phrases one can specify which preference is the basic one (Taraszkiewcz 2001).

## 3. THE INFLUENCE OF SENSORY PREFERENCES OF COURSE PARTICIPANTS ON THE ACQUISITION OF ENGLISH COMPLETED IN THE FORM OF BLENDED LEARNING

Due to the fact that learners' preferred sensory preferences may determine their personal learning strategy and way in which they communicate with other people, a test was conducted among students taking part in the research. The aim of the test was to specify students' preferred sensory system. A ready-made test taken from A. Smith's *Accelerated learning in the classroom* was used which is included in Figure 1. The research involved language groups which were divided into control and experimental ones. Control groups took part in a traditional English language course meeting the teacher face-to-face once a week for 90 minutes. Experimental group

took part in a blended learning English course where part of the course was platform based and the other one was face-to-face. Both control and experimental groups used the same syllabus and same materials.

This questionnaire was prepared to help you find your individual learning style.	
Answer all the below given questions using the scale:	
1 = NEVER 2 = RARELY 3 = SOMETIMES 4 = USUALLY 5 = ALWAYS	
Thank you for your answers!	
1. I learn words easier when look at them ir write them on a piece of paper.	
2. I learn something faster when listening or reading a textbook.	
3. I prefer classes where we repeat was we read in the textbook.	
4. While learning I like to eat something or chew a gum, etc.	
5. When I listen carefully during classes I remember better main points without writing them.	
6. I prefer written to oral tasks.	
7. I am good at solving crossword puzzles, puzzles etc.	
8. I prefer classes when we repeat what was said during them.	
9. Slides and films help me understand a topic.	
10. I remember more by reading than listening to lecture.	
11. To remember phone numbers I need to write them down.	
12. I prefer to listen to the news on the radio than read newspapers.	
13. While learning I like to keep something in my hand.	
14. I need to rewrite from the blackboard examples given by the teacher to be able to revise them later.	
15. I prefer teacher's spoken orders to those written on the board or in the text.	
16. I prefer if the textbook includes maps, charts, pictures because these help me understand better.	
17. I like listen to the tape-recorder while learning.	
18. I need to prepare a list of task to do.	
19. I can check my work by looking at it, I 'catch' most of mistakes.	
20. I prefer to read a newspaper rather than listen to the news or watch them on TV	·
21. I can remember phone numbers when I hear them.	
22. I like to do tasks which involve my hands and tools.	
23. When I write something I need to read it aloud to check how it sounds.	
24. I remember better if I can move while learning: walk around the class, take art	
in a game, etc.	

### Figure 3. Sensory preferences test

### Source: Smith A., Accelerated learning in the classroom, 1997

It is a test in which each surveyed person was to give answers to twenty-four questions by marking next to them their answer according to a points scale: 1 =

never 2 = rarely 3 = sometimes 4 = usually 5 = always. Then points given next to each question were transferred into answer sheet including three columns referring to three sensory preferences (visual, auditory and kinaesthetic). Points in each of the columns were added, the results (the highest score) in a column pointed at the preference ascribed to it.

#### Table 2.

Sensory preferences	kinaesthetic		audi	tory	Visual	
group	Ν	%	Ν	%	N	%
1	0	0,00	0	0,00	15	100,00
2	1	7,14	2	14,29	11	78,57
3	2	16,67	3	25,00	7	58,33
4	2	13,33	6	40,00	7	46,67
5	1	8,33	2	16,67	9	75,00
Control group	6	8,82	13	19,12	49	72,06
6	2	14,29	1	7,14	11	78,57
7	2	15,38	2	15,38	9	69,23
8	2	16,67	2	16,67	8	66,67
9	1	7,69	3	23,08	9	69,23
10	0	0,00	4	26,67	11	73,33
Experimental group	7	10,45	12	17,91	48	71,64

### The surveyed sensory preferences with division into language groups

## Source: authors' source

In both groups there was the highest percentage of visuals - 49 students that is 72.06% in control group and 48 students in experimental group 71.64%. The next highest in number group was made out of auditory learners (19.12% in control group and 17.91% in experimental group). The least represented were kinaesthetic – 8.82% (6 students) in control group and 10.45% (7 students) in experimental group.

In both groups the distribution of students having specific preferences was similar. That means that their sensory preferences had no influence on the experiment.

The presented in Table 3 data allows to form a hypothesis that the sensory preferences represented by the survey and the used method of teaching have no influence on the raising of the level of knowledge

## Table 3.

## Sensory preferences of the surveyed divided into control and experimental groups

~		group				7
Sensory preferences	control		experimental		totai	
	Ν	%	N	%	N	%
visuals	49	72,1	48	71,6	97	71,9
auditory	13	19,1	12	17,9	25	18,5
kinaesthetic	6	8,8	7	10,4	13	9,6
total	68	100,0	67	100,0	135	100,0

 $\chi^2$ =120, df=2, p=0,942

## Source: authors' source

An analysis concerning concurrence of the analysed variables with normal distribution was conducted. Due to the fact that only variables in the group of kinaesthetic learners are of a normal distribution the analysis was based on non-parametric Kruskal-Wallis H test.

## Table 4.

## Measure of the concurrence with normal distribution raising level of knowledge variables

Sensory preferences	visuals	auditory	kinaesthetic
Ν	97	25	13
x	16,27	15,52	16,69
S	7,745	6,358	7,653
Z Kołmogorow- Smirnow	2,915	1,407	1,062
р	<0,001	0,038	0,210

Source: authors' source

A zero hypothesis was formed about lack of differences between students having different sensory preferences and an alternative hypothesis that the differences between raising of the level of knowledge due to different sensory perceptions exist.

### Table 5.

Sensory preferences	N	Mean	$\chi^2$	р
visuals	97	68,17		
auditory	25	66,96	0,025	0,988
kinaesthetic	13	68,73		

Differences in raising the level of knowledge depending on sensory preferences

### Source: authors' source

In the whole group of the surveyed there is no reason for which a zero hypothesis could be rejected, so it has to be assumed that there are no differences in the raising of the level of knowledge between students who have different sensory preferences.

#### Table 6.

## Differences in the raising of the level of knowledge depending on the preferred sensory channel in control group

Sensory preferences	N	Average weight	$\chi^2$	р
visuals	49	30,91		
auditory	13	49,65	11,422	0,003
kinaesthetic	6	31,00		

## Source: authors' source

While analysing only students from control group it can be noticed that with the probability of error equalled 0.3%, in this group better results are achieved by auditory, the next ones are kinaesthetic and visuals (only slight differences).

Similarly in experimental group - with the probability of error equalled 0.4%, it can be stated that the weakest results were achieved by auditory learners.

It means that for learners with this type of sensory preferences traditional method is more effective, for the remaining learners blended learning is effective.

## Table 7.

## Differences in the raising of the level of knowledge depending on the preferred sensory channel in experimental group

Sensory preferences	N	Average weight	χ²	р
visuals	48	38,21		
auditory	12	17,71	10,975	0,004
kinaesthetic	7	33,07		

Source: authors' source

Presented in table 7 data allows to form a hypothesis that preferred sensory preferences and the used teaching method have influence on the permanence of knowledge.

## Table 7.

## Measure of the concurrence with normal distribution variable knowledge permanence

Sensory preferences	visuals	auditory	Kinaesthetic
Ν	93	24	13
x	-0,06	-0,29	-0,23
S	1,284	1,546	1,423
Z Kołmogorow- Smirnow	1,829	0,865	0,603
р	0,002	0,443	0,861

Source: authors' source

Not all the variables are of a normal distribution that is why also nonparametric tests were used (H Kruskal-Wallis).

A zero hypothesis was formed about lack of differences between learners with different sensory preferences and the permanence of knowledge.

Neither in the whole group nor in control or experimental group can the zero hypotheses be rejected. It means that sensory preferences and the used method of teaching have no influence on the permanence of knowledge.

## 4. CONCLUSION

There are many factors influencing the ability to acquire knowledge, among which the most often mentioned are factors such as: emotional, sociological, physiological and psychological ones (Janowicz, 2009). In the surveyed group of students attention was mostly paid to environmental factors (place of learning), sociological (methods of teaching) and physiological ones (sensory perceptions). English blended learning (joining traditional classroom meetings and educational platform Moodle tasks) course programmes were designed having in mind students who could differ in their sensory preferences. While preparing materials some deliberate activities were promoted - students had activities (both face-to-face and online) prepared in such a way as to be fully involved in the activities based on modification, synthesis, active use of acquired information, which was to enable them conscious use of acquired competencies in practice. The materials which the surveyed could access were texts, graphics (static or dynamic), audio, video, required student's interaction - so they referred to the three types of sensory preferences. Thus the relationship between sensory preferences of students and the way of conducting classes and the influence of these factors on the permanence of knowledge was difficult to be observed while conducting the research. The surveyed both during traditional and online meetings received different preferred by them stimuli: visuals could access information in graphical form (texts, pictures, drawings, films); auditory could lead conversations, group discussions and listen to some files; kinaesthetic learned due to performing tasks both while face-to-face and online meetings, by direct interaction within the group or with materials.

The form of classes by connecting the advantages of traditional education (face-toface) and network based learning did not significantly influence the acquisition and permanence of knowledge. The observation is in opposition to the research results from the United States of America. According to the report published by US Department of Education people learning online achieve better learning results than those who took part in traditional classes conducted only face-to-face. It results most often from the fact that people who learn in a distance way spend on work and learning in the net more time than the participants of traditionally conducted courses (see. Understanding the Implication of Online Learning for Educational Productivity, 2012). It can be assumed that the differences shown between the results conducted in Poland and in the USA may result from local conditions; in our country e-learning is still not a very popular form of education without long tradition. Emotional factors (motivation, persistence, reliability and dutifulness) could also in case of blended learning influence, the comparable to traditional education, the level of acquisition and permanence of knowledge. In order to confirm these speculations it is necessary to conduct further research.

## REFERENCES

- Janowicz, M., 2009: *Learning chosen issues*, Folia Pomeranae Universitatis Technologiae Stetinensis, Oeconomica 273 (56), pp. 73-82, ISSN: 2081-0644 [In Polish]
- *Key competencies in lifelong learning European framework of reference* (2006), Dziennik Urzędowy Unii Europejskiej 30.12.2006, L 394/13 [In Polish]
- Sharma, P., 2010: *Blended learning*, ELT Journal, Volume 64/4, Oxford University Press, 2010, pp. 414-423, ISSN: 978-1441150219
- Silberman, M., 2005: *Learning how to teach*, GWP, Gdańsk 2005, pp. 20, ISBN: 83-89574-19-5 [In Polish]
- Smith, A., 1997: Accelerated learning in the classroom, WOM, Katowice, 1997, pp. 21, ISBN: 8386814810 [In Polish]
- Taraszkiewicz, M., 2001: *How to teach better. School full of people*, Wydawnictwo ARKA, Poznań 2001, pp. 63, ISBN:9788388860126 [In Polish]
- Thornbury, S., 2006: An A-Z of ELT, Macmillan, 2006, pp. 116-117, ISBN: 978-4-89471-854-8
- Understanding the Implication of Online Learning for Educational Productivity, 2012: US Department of Education, available at http://www.sri.com /sites/default/files/publications/implications-online-learning.pdf, (accessed on 20 June 2013).
# THE EVALUATION OF THE QUALITY OF TEACHING A FOREIGN LANGUAGE WHEN APPLYING E-LEARNING

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Abstract: The article deals with the analysis of the attitudes of the students to the *E*-learning form of education. The evaluation of the quality of foreign language education has been carried out in the course Professional English 1, which is a whole-faculty and compulsory subject offered in the framework of the subject Foreign Language Preparation for a period of four semesters. There is an option of choosing English and German as a foreign language for the students at School of Business Administration in Karviná in the full-time and combined form of teaching. Within the combined form of teaching *E*-learning teaching practices are applied that have become the subject of the survey. In the introduction, the significance of *E*-learning in education is described, in the ensuing part of the article the theoretical background of *E*-learning is mentioned, which then is followed by a description of the objectives and methods used for research. Subsequently, there is a detailed analysis of the results of the survey and in the end the most essential aspects of this form of education are summed up.

**Keywords:** E-learning, evaluation, distance learning, foreign language, learning support material lessons, research, survey, teaching

## **INTRODUCTION**

E-learning is an important method of education in the world, which contributes to the modernization and optimization of the educational process in all spheres of society. It represents a potential power one needs to reckon with in the future.

It turns out that E-learning could become a flexible method of how to quickly and flexibly respond to the need for further training of staff in the employability on the labour market. In the tertiary sector, E-learning has become one of the methods of university education, which deserves attention and the survey.

Teaching in the form of E-learning also has a tradition of School of Business Administration in Karviná (hereafter OPF) that began in 2004 by establishing the

Department of E-learning, which provides technical and pedagogical training for teachers, as well as students at OPF.

## **1. THEORETICAL BASE**

Compared with foreign countries the professional literature in this field of education is rather neglected in our country, what can be judged from the number of monographic titles to a formal education. In short, let us mention at least the enumeration of domestic authors dealing with this issue. Here we can come across the following authors: Květoň 2003, Nocar 2004, Barešová 2003, Kopecký 2006, Zlámalová 2009, Vaněk 2008, Zounek 2009, Pejsar 2007 and more.

The countless conferences have paid attention to E-learning, let us just list here for instance: The National Conference Proceedings on the 1<sup>st</sup> Distance Education in the Czech Republic (1999), The National Conference Proceedings on the 2<sup>nd</sup> Distance Education in the Czech Republic (2002), The National Conference Proceedings on the 3<sup>rd</sup> Distance Education in the Czech Republic (2004), The National Conference Proceedings on the 4<sup>th</sup> Distance Education in the Czech Republic (2004), The National Conference Proceedings on the 4<sup>th</sup> Distance Education in the Czech Republic (2006), The (4th) National Conference on Distance Education in the Czech Republic – the Present and the Future, The 5<sup>th</sup> National Conference on Distance Learning in the Czech Republic – the Present and the Future of Alternative Teaching Methods 2009, etc.

## 2. AIM AND RESEARCH METHODS

The aim of the research was to make a survey among the students studying the given course at OPF in one semester of teaching. For the purposes of the survey, the second semester of study was chosen, in which the study of a foreign language begins. The contents of the survey was the evaluation of the quality of teaching along with the study material, on which this form of teaching is based.

The students' attitudes were subject to the evaluation survey towards the E-learning form of teaching, too, which affect the planning and implementation of education in future years.

We have selected evaluation methods with regard to the need for the application of knowledge acquired in the course of Professional German 1 in professional life and in the labour market. Settings for individual indicators were based on the syllabus of the accredited course and the specific learning support material, which was specially created for the course. The measurement of indicators were in progress throughout the semester, and it proceeded from oral as well as written outputs specified in the syllabus of the course.

The analysis of quality indicators focused on the lexical, grammatical and communication levels. The proper questionnaire survey was carried out in the last teaching week and aimed at evaluating the course and the teacher. Furthermore, the auto-evaluation method was used through which we tried to map out what prevented us from reaching better results with the students or what helped to improve foreign language skills. With the auto-evaluation, the attention was focused on the following aspects:

- The appropriateness of the number of the given lessons.
- The suitability of the chosen form of teaching.
- A sufficient number of lessons in a full-time part (tutorials) of teaching.
- The usefulness of the content of the course in applying the graduates in practice.
- Entry level of the knowledge of the students.
- Provision of the course with study materials.
- The activity of the students and their interest in learning.

In addition, it should be noted that the definition of the objectives of the research is based on the needs of the evaluation of the educational process, with a view to its further modernization and continuous improvement. The questionnaire survey contained the following questions:

- The contents of the course, which I attended, was in accordance with the course syllabus.
- The course contained a sufficient amount of information for me in the given field.
- I was previously informed enough about the conditions for the successful completion of the course.
- Examples were understandable for me.
- Control questions were understandable for me.
- Examples with respect to the content were in sufficient quantity.
- Control questions in relation to the content were in sufficient quantity.
- Pieces of knowledge of the course are useful, I suppose, that I will use them in the next study or practice.
- Teaching material on the course was understandable for me.
- The time range to cope with the issues of the course was sufficient for me.
- The form of teaching through the LMS Moodle suited me.
- The course was in the LMS Moodle presented sufficiently clearly and intuitively.
- A full-time part of the teaching/tutorials/was/were important to cope with the curriculum.

- A full-time part of the teaching/tutorials/was/were well prepared and the lecture was understandable.
- Course teachers in a given area were erudite and prepared for the lesson.
- Course teachers communicated without any problems and shared his/her experience with the students in the appropriate form.
- Course teachers led the course in a flexible way, with an individual approach to the students.
- The teacher was inspiring.
- Overall, my course in terms of the content, form, access of the teacher as well as its benefit suited me.

The above stated questions were to be rated in the range of 1 to 5, and the choice of a numerical grade 1 was the best evaluation and the choice of the number of grade 5 was the worst point rating.

## 3. THE RESULTS OF THE AUTO-EVALUATION

On the issue of the appropriateness of the number of the given lessons teachers disposed to the view that in order to ensure an adequate quality of the output of the educational process the bigger number of the given lessons would be more desirable. As to the form of teaching and its suitability no additional considerable comments occurred. However, it was considered that the entry level of the knowledge of a foreign language is decreasing from year to year. Then the teachers positively evaluated the provision of the course with study materials, the activity of the students and their interest in teaching and in particular they stressed the usefulness of the course in the application of the graduates in practice.

## 4. THE RESULTS OF THE SURVEY

The survey was attended by a total of 61 students. The results of the survey are present in the well-arranged charts.

Table 1.

## The content of the course, which I attended, was in accordance with the course syllabus

Numerical evaluation	The number of students
1	46
2	13
3	1

4	1
5	

Source: The results of the survey conducted at OPF in Karviná

This question was addressed to the students, in order to determine the extent to which it complies with the syllabus approved by the Accreditation Commission. The results of the survey show only negligible deviations from the accredited abstracts, which can for example manifest the creativity of teachers in the given course.

#### Table 2.

## The course contained a sufficient amount of information for me in the given field

Numerical evaluation	The number of students
1	31
2	19
3	8
4	2
5	1

Source: The results of the survey conducted at OPF in Karviná

The second question belonged to one of the most important points in the framework of the survey, as it demonstrated the importance of the newly acquired information for the students. The students' responses at this point clearly indicate that the contents of the course was selected properly and for the students it has its foundations in the course of the studies at SU OPF in Karviná.

#### Table 3.

## I was previously informed enough about the conditions for the successful completion of the course

Numerical evaluation	The number of students
1	46
2	9
3	6
4	
5	

Source: The results of the survey conducted at OPF in Karviná

The awareness of the students on the conditions for the successful completion of the course is extremely important. The students, in particular, in the combined and E-learning forms of teaching must have all the information at the beginning of the study of the course, in order to limit the number of the failed students. Most of the students received the right information right at the beginning of the course. The table only shows that communication with the students in the future can still be optimized so that students should not have the feeling of the limited awareness.

#### Table 4.

Numerical evaluation	The number of students
1	29
2	29
3	3
4	
5	

#### Examples were understandable for me

Source: The results of the survey conducted at OPF in Karviná

Through this query we examined the clarity of the learning support material for the students. The results of the survey may be optimistic for us. The rating was dominated by the number one and number two, which shows that the students didn't have a bigger problem with understanding the tasks and exercises in the learning support material. Only in three cases, there was the rating with the number 3.

#### Table 5.

Numerical evaluation	The number of students
1	25
2	31
3	5
4	
5	

Control questions were understandable for me

Source: The results of the survey conducted at OPF in Karviná

At the end of each lesson there were control tasks that should determine whether the student acquired the required knowledge to a sufficient extent. We can feel confident about the evaluation provided by the students. 25 students rated this question with

the number one, 31 students with the number two and, five students marked the answer with the number 3. The answer distribution indicates that there may be students who have more trouble as for coping with the curriculum than others.

#### Table 6.

Numerical evaluation	The number of students
1	24
2	23
3	10
4	4
5	

Examples with respect to the content were in sufficient quantity

Source: The results of the survey conducted at OPF in Karviná

Through this query we explored whether the examples with respect to the content were in sufficient quantity. In this respect, it is to be reckoned with in the future that it will be necessary to incorporate a greater amount of examples to practice a given subject matter.

#### Table 7.

Numerical evaluation	The number of students
1	29
2	20
3	9
4	3
5	

Control questions in relation to the content were in sufficient quantity

Source: The results of the survey conducted at OPF in Karviná

The results of the survey whether the control questions in relation to the content were in sufficient quantity show that the work with the students offers more room for a better didactic implementation of the course. It is quite clear that, in this respect, it will be desirable to supplement the control questions in the teaching so that they were in sufficient quantity relative to the content for the larger number of the students.

#### Table 8.

in the next study or practice	
Numerical evaluation	The number of students
1	35
2	19
3	7

Pieces of knowledge of the course are useful, I suppose, that I will use them in the next study or practice

Source: The results of the survey conducted at OPF in Karviná

4

The benefit of the course for the students is the most significant aspect of the evaluation. It shows the compatibility of the course with the given study programme and a field of study, at the same time it suggests a link with the employability on the labour market. 35 students marked this question with the number one, 19 students with 2 and only 7 students with the number 3. It is gratifying that most students are aware of the importance of the course for the practice and its further use in further study or in practice. At the same time we received quite a clear feedback from the students that they are aware of the importance of a foreign language in practice.

#### Table 9.

Numerical evaluation	The number of students
1	34
2	21
3	5
4	1
5	

Teaching material on the course was understandable for me

#### Source: The results of the survey conducted at OPF in Karviná

The evaluation of the teaching material is satisfactory. 34 students marked this question with the number 1, 21 students with the number 2, 5 students with the number 3 and 1 student with the number 4. Overall, it can be concluded that the satisfaction of the students is satisfactory. In the future, it will only be necessary to focus on those students, for which the teaching material is less comprehensible, and to find out what this evaluation is related to. It can be assumed that one of the reasons may be for example the lack of an entry level of the students, which is necessarily reflected in this assessment.

#### Table 10.

Numerical evaluation	The number of students
1	14
2	20
3	18
4	8
5	1

The time range to cope with the issues of the course was sufficient for me

Source: The results of the survey conducted at OPF in Karviná

Having been asked, if the time range to cope with the issues of the course was for the students sufficient, clearly shows that the time range for the teaching of a foreign language is not quite perfect. The time limitations of the contact certainly reflected the evaluation of this query. 14 students marked the answer with the number 1, 20 students with the number 2, 18 students with the number 3, 4 students with the number 4 and 1 student with the number 5. It will be desirable to focus on the outcome of the survey and take this aspect into account in the future accreditation material.

#### Table 11.

## The form of teaching through the LMS Moodle suited me

Numerical evaluation	The number of students
1	29
2	20
3	10
4	1
5	1

Source: The results of the survey conducted at OPF in Karviná

What is surprising is the finding that the form of teaching through the LMS Moodle for the students was rather suitable. 29 students opted for 1, 20 students for 2, 10 students for 3, 1 student for 4 and 1 student for 5 in their rating.

#### Table 12.

The course was in the LMS Moodle presented sufficiently clearly and intuitively

Numerical evaluation	The number of students
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1	30
2	24
3	6
4	1
5	

Source: The results of the survey conducted at OPF in Karviná

#### Table 13.

A full-time part of the teaching/tutorials/was/were important to cope with the curriculum

Numerical evaluation	The number of students
1	34
2	12
3	5
4	6
5	

Source: The results of the survey conducted at OPF in Karviná

Assessing this query, whether a full-time part of the teaching/tutorials/was/were important to cope with the curriculum, shows that 34 students inclined towards the number 1, 12 students opted for 2, 5 students acceded to a rating of 3 and 6 students rated the question with the number 4. It can be therefore concluded that for most students a full-time part of the teaching/tutorials/to cope with the curriculum is important.

#### Table 14.

A full-time part of the teaching/tutorials/was/were well prepared and the lecture was understandable

Numerical evaluation	The number of students
1	42
2	13
3	4
4	1
5	1

Source: The results of the survey conducted at OPF in Karviná

The query on the preparedness of the full-time part of the teaching can please the teachers. Most of the students inclined to think that a full-time part of the teaching/tutorials was/were prepared well and the lecture was understandable. 42 students rated with the number 1, 13 students voted for 2, 4 students rated with the number 3, 1 student evaluated with the number 4 and 1 student chose even the lowest rating of 5. It could be stated that it will be of utmost importance to incorporate the needs of all students and work with them empathetically in the lessons.

#### Table 15.

Numerical evaluation	The number of students
1	51
2	6
3	4
4	
5	

Course teachers in a given area were erudite and prepared for the lesson

Source: The results of the survey conducted at OPF in Karviná

In addition to the queries on the prepared course, the quality of the learning support material, and the satisfaction of the students, the survey also was focused on the assessment of the quality of teachers. The results of the evaluation are comparatively satisfactory. 51 students rated with the highest number 1, 6 students inclined to a rating of 2, and only 3 students chose a rating of 3. Once again, it appears that in the foreign language teaching it is important to impress the students with preparedness and erudition, as it is evidenced by the answered questions below.

Table 16.

Course teachers communicated without any problems and shared his/her experience with the students in the appropriate form

Numerical evaluation	The number of students
1	46
2	10
3	2
4	3
5	

Source: The results of the survey conducted at OPF in Karviná

We can be quite satisfied with the evaluation of the query, whether the course teachers communicated without any problems and shared his/her experience with the students in the appropriate form. As already mentioned above, the teacher's communication appears to be a decisive factor in the evaluation of the course by the students. 46 students assessed with the number 1, 10 students with the 2, 2 students with the number 3 and 3 students with the number 4. The future, however, will require more communication than hitherto and this quality indicator must be taken seriously.

#### Table 17.

## Course teachers led the course in a flexible way, with an individual approach to the students

Numerical evaluation	The number of students
1	36
2	17
3	8
4	
5	

Source: The results of the survey conducted at OPF in Karviná

Flexibility and an individual approach are becoming desirable attributes with the students. The students appreciate the individual access to them and their attitudes are visible even from the result of a questionnaire survey. 36 students are completely happy about the teacher's flexibility and individual approach, 17 students opted for the number 2 and 8 students selected the number 3.

#### Table 18.

Numerical evaluation	The number of students
1	36
2	18
3	4
4	3
5	

Teaching was inspirational.

Source: The results of the survey conducted at OPF in Karviná

Questions from 13 to 15 concentrated on the personality of the teacher, with all the consequences that a person may have on the quality of teaching, the course, the field of study or even the university. It should be noted that the quality of school is made,

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inter alia, by the quality of teachers. 36 students rated the teacher with the highest number 1, the same number of students opted for the number 2 and 5 students assessed it with the number 3. As a result, it is impossible to underestimate the role of the student in the classroom, it is necessary to work with it and integrate it suitably to the educational process too.

#### Table 19.

Overall, my course in terms of the content, form, access of the teacher as well as its benefit suited me

Numerical evaluation	The number of students
1	28
2	28
3	5
4	
5	

Source: The results of the survey conducted at OPF in Karviná

The final query resulted in a summary of the positions of the students to the course, the form and content of teaching and the teacher as well as to the overall benefit. The questionnaire survey among the students showed that most students assess all positively. 28 students opted for the number 1, 28 students opted for the number 2 and 5 students resorted to the number 3.

#### CONCLUSION

The E-learning form of education represents a modern form of teaching, through which the students find it easier to overcome time, professional, and financial or health barriers. It enables them, in spite of the distance, to supplement their necessary education. At the same time it offers an alternative in the form of the educational process. However, it is important to remember the pitfalls of this form of education in particular with regard to the subject of education.

Learning a foreign language is a demanding process of acquiring knowledge and skills, where the teacher's job is an indispensable part of it. The individual approach of the teacher, his/her flexibility and empathy towards the students are important attributes leading to the active knowledge of a foreign language.

This self-regulated education for learners represents the pitfalls, in particular in a foreign language teaching. Although in terms of the content and form of teaching it can meet the students' needs, in terms of the quality of the educational process it faces constraints. The language as a means of communication is necessary to develop in communication and the teacher plays a key role in it.

#### REFERENCES

- Květoň, K., 2004: *The basics of e-learning 2003*. Ostravská univerzita: Ostrava 2004, 61 p. ISBN: 80-7042-986-0.
- Nocar, D., 2004: *E-learning in distance education*. Olomouc: Univerzita Palackého 2004, 77 p. ISBN: 80-244-0802-3.
- Barešová, A., 2003: *E-learning in adult education*. Prague: VOX, 2003. ISBN: 80-86324-27-3 2.
- Kopecký, K., 2006: *E-learning (not only) for pedagogues.* 1st edit. Olomouc: Hanex, 2006. 130 p. ISBN: 80-85783-50-9.
- Zlámalová, H., 2008: Distance learning and e-Learning-teaching text for distance learning Prague: Univerzita Jana Amose Komenského Praha, 2008. 144 p. ISBN: 978-80-86723-56-3.
- VANĚK, J., 2008: E-learning, one of the ways towards modern forms of education. Karviná: Slezská univerzita v Opavě, 2008. 96 p. ISBN: 978-80-7248-471-3.
- Zounek, J., 2009: *E-learning-one of the forms of learning in modern society*. 1st edit. Brno: Masarykova Univerzita, 2009. 161 p. ISBN: 978-80-210-5123-2.
- Pejsar, Z., 2007: *Electronic education*. Univerzita J. E. P. v Ústí nad Labem, 2007, ISBN: 978-80-7044-968-4.

## MULTIMEDIA COURSE IN CZECH: LEVEL A2

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Abstract: The article deals with the development of E-learning Czech language materials at the level A 2 within the CEFR, elaborated within the international project L-Pack. The course involves 12 units, each consisting of 5 basic videos followed by other exercises, presentation of grammar structure, vocabulary, speech acts, and last but not least culture information. The paper will also focus on the process of elaborating the language material and using IT in the foreign language instruction, namely the method of computer-assisted language learning. The Manual with videos and Guides for teachers and self learners accessible on the Internet through Wikibooks, YouTube and Soundcloud are also described. The texts are meant for migrants and are supposed to provide them with basic knowledge of the host society's language, history, and institutions which is indispensable to integration.

Keywords: E-learning, language instruction, video course in Czech language.

#### **INTRODUCTION**

The article will focus on a new multimedia teaching material of Czech for foreigners which has been elaborated within the project "L-PACK: Citizenship Language Pack For Migrants in Europe" of Lifelong learning, N°11529-LLP-1-2010-1-IT-KA2-KA2MP, by the Department of foreign languages and communication of the School of Business Administration in Karviná (Silesian University in Opava). It illustrates the most important stages of its elaboration. At the beginning, it tackles E-learning as an effective method of language instruction. After it concentrates at the need analysis which was aimed at the findings concerning a description of the background in teaching Czech as a second language to migrants in CR, and also opinions of learners and teachers as what topics should be covered in the teaching material.

The stages of creation of modules with pilot phase and modifications have also taken into consideration the results of the analysis. The last part focuses on the working version of the Manual and Guides for teachers and self-learners.

## 1. LEARNING ON LINE

Nowadays, in the world of dynamic growth of new technologies, not a foreign language instruction seems to be behind. We can witness a rapid rise of using electronic learning. E-learning comprises all forms of electronically supported learning and teaching. The information and communication systems, whether networked or not, serve as specific media to implement the learning process. The term will still most likely be utilized to reference out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to devices and curriculum (http://en.wikipedia.org/wiki/Elearning).

E-learning in the narrower sense can be understood "as education which is supported by modern technology, which is implemented through computer networks especially the Internet and intranet" (Kopecký 2006:59). In other words it is essentially the computer and network-enabled transfer of skills and knowledge. It can be stated that E-learning applications and processes include Web-based learning, computer-based learning, virtual classroom opportunities and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. It can be self-paced or instructor-led and includes media in the form of text, image, animation, streaming video and audio. Our material is delivered via the Internet including especially videos of the scenes within the selected topics together with practice and exercises meant for the independent learning without a face to face teacher's support.

On the one hand, the Internet offers some opportunities to access a wider range of texts, audios and videos for those who are interested in learning minority foreign languages. On the other hand, suitable resources for teaching and learning minority languages cannot be that easy to find and access electronically, which has led to calls for the increased development of materials for minority language teaching.

## 2. LIFELONG LEARNING AND MIGRATION

The term lifelong learning implies that learning is not confined to pupils or students or the classroom but takes place throughout life and in a range of various situations. It follows that it is one of the most suitable way how to teach a host language to migrants.

According to Commission of the European Communities the challenge for lifelong learning means support of the integration of migrants in the given society and the economy. It also covers making the most of the competences and educational experiences acquired prior to migration. The area involved includes the following:

- EU support policies and action through relevant programmes which may improve the quality of education and training policies;
- speeding up mechanisms for assessment of capacities and recognition of formal, non-formal and informal learning of arriving migrants;

- expanding adult learning opportunities in relation to linguistic, social and cultural integration;
- developing appropriate and effective teaching and promoting more intercultural learning.

(http://eurlex.europa.eu/LexUriServ/site/en/com/2006/com2006\_0614en01.pdf)

It follows that in the framework of the above mentioned the new presented course in Czech language called L-Pack (Language Pack) can contribute to the objectives of Commission of the European Communities.

The language material is specifically developed to cover the needs of adult migrants that have only basic knowledge of national language and wish to further develop their language skills, according to level A2 set by the Common European Framework of Reference for Languages (CEFR).

In the preparatory phase, it was confirmed that almost all the available materials for teaching their language as L2 are addressed to wealthy / cultured people that travel for leisure or study. A desk research carried out showed the 10 colloquial L2 courses which were examined (5 for teaching IT, 2 ES, 2 DE, 1 EL) focus mostly on leisure activities: going out to a pub or restaurant, shopping, visiting museums and monuments, travelling in the country, dating.

The subsequent research within the need analysis phase confirmed the finding s of the desk research. On the contrary, the typical situations faced by migrants (to settle in a new country, to look for a stable accommodation, to look for a job, to cooperate with employer and co-workers in a foreign country) are ignored or marginal.

## **3. CZECH FOR FOREIGNERS: L-PACK IN LLP**

#### 3.1 Need Analysis

#### **3.1.1 The Overview of the Existing Material**

In the need analysis, it was found out that one of the most important bodies which plays the crucial role in Czech language instruction is Institute for Language and Preparatory Studies at Charles University in Prague not only offering many preparatory courses of Czech also for migrants, but developing various teaching materials which are often created in cooperation with Czech and European institutions, especially materials for the distance learning courses. The institute is also respected for its research and methodological presentations. They have created very interesting CZECH ONLINE COURSE - Breakthrough Czech Online Course, but for the time being at A1 level.

However, many textbooks reaching A2 level are worked out at universities where foreign students come to study for a short period. These materials present general

topics related to students' life above all therefore they are not very suitable for our target group. A list of textbooks and further materials recommended for the instruction of the Czech for Foreigners and preparation for an examination may be found on the Internet, covering 10 essentials materials including CD-ROM.

However, not all of them declare A2 level. The four skills: listening, writing, speaking and reading are presented in a balanced way. Only some of them present socio-cultural section which is needed for everyday life in a foreign country. The topics which are usually included involve the following: basic personal and family information, shopping, eating in a restaurant, people, education, every day life, daily routines, local geography, employment, free time.

#### 3.1.2 The Methodology Used in the Analysis of Questionnaires

The questionnaires (for learners and tutors) were developed by the Lithuanian partner and after some modifications made on the basis of other partners' suggestions and translating into national languages, they were delivered to respondents in each country. As for the questionnaires for 10 teachers, we delivered them to Czech teachers in the Silesian region mostly by mail, the rest was worked out on the basis of interview.

As migrants concerned, the delivery was more complicated. We intended to have wider range of respondents' nationalities (corresponding to the number of migrants in the Czech Republic), and places of living, therefore, we delivered the questionnaires in more regions and to almost 90 migrants who were addressed face to face either personally, or in the classes in Czech courses in Prague, Ostrava, and Karviná. We have received a relatively high number (78) completed questionnaires out of which 40 ones were selected taking in consideration variety of respondents' nationality, age and place where the respondents live.

However, it should be said that our choice could not reflect nationality of the interviewees as it was impossible to obtain back questionnaires from the Vietnamese who form the second biggest group after the Ukrainians in the country (only one questionnaire returned).

#### 3.1.3 The Analysis of the Questionnaires

In the following sections the analysis results and findings are presented. The first section deals with the teachers' questionnaires, the second part tackles learners' responses. In the questionnaires for teachers, 2 males and 8 females have participated with the average age of 44.2 years. All the respondents have reached master's degree; in addition to that, four teachers have Ph. D. degree. All the respondents are of Czech nationality, and all are Czech teachers. The majority (8) teach at university, the others work at secondary school. The average number of their teaching Czech is 21.5 years whereas teaching of Czech as a foreign language reaches 3.6 years. The interviewees state that the average number of learners in the group of Czech language is 11.9. The respondents mention that one half of them have already prepared some methodological materials for their teaching Czech.

The language skill they think the learners need the most are as follows: everyday communication, reading headlines and speaking. The answers to the question concerning educational materials include such qualities as briefness and clarity, and then summary of grammar, phrases in tables, speaking, more audiovisual aids, more authentic materials are given.

According to the respondents, the textbook should contain the following main topics: personal matters, family, meeting people, travelling, shopping, in a restaurant, at the doctor, describing things, sociocultural pages, and transport. According to the findings, the teachers suppose that the migrants are motivated by the need to contact the people, study, find a job and pass state exam for permanent residence. The methods they use most to motivate the migrants are communicative role plays, dialogues, power point presentation, authentic practice, pictures, using the Internet, and different kind of motivating exercises. In teachers' opinion, the learning needs of migrants are especially needs of contacting Czech people, and improving qualification. The material needed for the language instruction covers audiovisual aids, textbooks with practice books, and illustrations. Among visualization tools which are lacked for successful learning are methodological materials, data projector, computer, and the Internet.

In summary, the findings show that the attention should be paid to communicative skills in everyday situations, the language and vocabulary related to finding a job and enhancing qualification. It appears that the topics reflect the above needs of the migrants for the integration into the new background.

As for the migrants' personal data, the average age of the analysed respondents (18 males and 22 females) is 26 years. The majority of them achieved secondary education (32), then bachelor's degree (6) and master's degree (2). The native language which prevails is Russian; the others include Ukrainian, Mongolian, Belorussian, Armenian, Georgian, Portugal, French, Vietnamese, and Arabian. The most of the respondents were born in Ukraine (14), then Russia (10), Belorussia and Mongolia (4), and others (Kazakhstan, Peru, Moldavia, Georgia, Uzbekistan, Tadzhikistan, Vietnam, and Egypt). The average length of stay is 10 years.

As for work topics, employment and working environment, hours, salary have been stated in 35 cases, after job entry in 33 questionnaires, activities in 28, cooperation with an employer and co-workers in 26, looking for a job in 23, both reception and personal qualities in 21, and internal structure in 18 cases. Within travelling, the most important seems to be travel transportation (34), travel activities (32), travel documents (29), and sights & activities (27). With respect to health topic, the respondents have indicated the items in the following order: going to a doctor (38), at drug store (36), hospital (27), and both general health and balance and wellness (20). In the last question including education topic, the following items have been indicated in the order: universities (35), school (24), library (20), conferences (10), and colleges (8).

Summarising the above findings based on the main needs of migrants, the upcoming teaching material should include especially the topics as meetings, acquaintance, shopping with money, time, employment and working environment, working hours, salary and job entry, transportation and travel activities, going to a doctor, at drug store, in hospital, universities, schools and libraries.

#### 3.1. 4. Need Analysis Conclusions

In the need analysis conclusion, it can be stated that the analysis findings show that the upcoming language material will be helpful for both teachers of Czech as a second language, and also migrants or learners because it will be tailored directly for language instruction of the target group who have had the opportunity to express themselves to the teaching material which they need in a foreign background to anage to be successful not only at the labour market, but also in everyday situations.

## 4. WORKING VERSIONS OF THE MANUAL AND GUIDES

### 4.1 Description of the Manual Content

Based on the need analysis, working versions were developed. The Manual consists of twelve modules with the following topics:

- 1. "Module: Authorities"
- 2. "Module: Communication"
- 3. "Module: Family and Socialising"
- 4. "Module: Health"
- 5. "Module: Job Hunting"
- 6. "Module: Leisure Time"
- 7. "Module: Looking for Accommodation"
- 8. "Module: School"
- 9. "Module: Self Education"
- 10. "Module: Shopping"
- 11. "Module: Travelling"
- 12. "Module: Working Life"

Each module of L-PACK comprises introduction to a module consisting of 5 units. Each unit begins with introducing the language material typical of a given topic, see below the introduction to Module 1. After it, a dialogue with various exercises practicing listening comprehension, pronunciation, vocabulary, speech acts, etc. follows, see fig. 2. In the second part of each unit, learners can find grammar and country page having sociocultural information, list of vocabulary with references to online dictionaries, and key.



V tomto modulu se nejdříve seznámíte s panem Balandou, který telefonuje do společnosti RED LINE, aby zjistil nějaké informace o práci. V druhém rozhovoru mluví dva přátelé o svých plánech na léto. Dále přátelé Ljuba a Pavel si povídají o zítřejších plánech a počasí. V dalším rozhovoru dvě kamarádky, Věra a Anna, spolubydlící, tráví spolu večer a chystají se dívat na televizi. V posledním rozhovoru zve Maria svou kolegyni na večeři, později obě zvou i vedoucí. V modulu si procvičíte telefonování s uvedením důvodu telefonického rozhovoru, zanechání vzkazu, ukončení hovoru a žádost o zavolání. Seznámíte se se slovní zásobou, která se týká kalendáře, času, počasí. Procvičíte fráze užívané při pozvání. V gramatické části budou vysvětleny číslovky. Na závěr si přečtete o médiích v ČR.

#### Obsah modulu

Titles of dialogues	Way of communication	Objective
Telephoning	Telephone call	Pronunciation of numerals
Calendar/time	Dialogue	Vocabulary
Weather/weather forecast	Dialogue	Giving information about weather and plans
Media/TV news	Dialogue	Numerals
Invitation – accepting, refusing	Dialogue	Sentence structure revision
In the Czech Republic	Informative text	Information about media

#### Figure 1. Illustration of a Module 1 Introduction

Source: https://asev.basecamphq.com/projects/6584759pack /files?category\_id=68914526&page=2

### Addition to the figure 1 in English:

Figure 1 is borrowed from the final version of the Manual for Czech, and shows the introduction to Module 1 with its presentation mentioning roles, topics, places, and description of the dialogues. In the table titles of dialogues, ways of communication and goals for the module are introduced.

#### Lekce 1

## Telefonování

**Rozhovor 1** (*Podívejte se na video na Youtube/poslechněte si nahrávku na www.lpack.eu – Modul 1.1*)



Secretary:	Good morning. Company REDLINE. Jana Fialová. Can I help you?
Mr Balanda:	Good morning. Adam Balanda. Could I speak to Mr Novák, please?
Secretary:	Yes, of course. I'll put you through to his office Unfortunately, Mr Novák is arranging something out in our branch. He's coming in the afternoon.
Pan Balanda:	Could you tell me when he is back, please?
Secretary:	In the afternoon, approximately after two o'clock he is going to be in his office.
Mr Balanda:	I see, could I call back after two then?
Secretary:	Yes, of course. But I you want you can leave a message here.

Pan Balanda:	Yes, it will be better. Could you tell him that Mr Adam Balanda has called and needs some information about the job interview for the driver at your company?
Secretary:	Well, I'll give the message to Mr Novák and he could call you back. What's your telephone number, please?
Pan Balanda:	753 897 987.
Secretary:	OK, I'll repeat that again, 753 897 988.
Mr Balanda:	No, no, it's 753 897 987. The last number is 7, not 8.
Secretary:	All right, thank you and to be sure I'll repeat the number again - 753 897 987.
Pan Balanda:	Yes, now it's all right.
Secretary:	So I'll tell Mr Novák, that Mr Balanda has called in the matter of the interview for the driver at our company and he 's supposed to call back to telephone number 753 897 987.
Mr Balanda:	Yes, thank you very much.
Secretary:	Not at all. Good bye.
Pan Balanda:	Good bye.

Figure 2. Illustration of Lesson 1 Dialogue.

Source: https://asev.basecamphq.com/projects/6584759pack /files?category\_id=68914526&page=2

## Addition to the figure 2 in English:

Figure 2 is also borrowed from the final version of the Manual for Czech. Learners are instructed to watch the video on Youtube or listen to the audio on <u>www.l-pack.eu</u> – Modul 1.1. After the table describing the situation, persons and place, the text of the whole dialogue is presented. Then the first dialogue of the Module 1 follows, focused on telephoning in which Mr Balanda is calling to arrange a meeting with REDLINE company. The responsible person is out of the office so he has to leave a message with the secretary.

## 4.2. Description of the Guides

The modules are accompanied with two guides – Guide for teachers/tutors and Guide for self learners. Both of the texts include the following matters:

- Presentation of the guide
- Who the course has been made for
- Aims of the course
- Course resources

- Contents of the course
- Organization of the Modules
- How to use the course
- How to use the course with a teacher
- Suggestions for the use of the Units
- How to use the course in a mixed situation of learning
- Feedback
- Resources on the web

However, it was very difficult to develop the text which is clear and understandable especially for language learners at level A2, it can be stated that the guides were evaluated very well by both the self learners and tutors in the Pilot Questionnaire.

The following illustration shows the content of the course in the www sites of the L-Pack comprising both the Guides, and 12 modules.

Figure 3 illustrates Guide for teachers, Guide for learners and all the course in Czech comprising 12 modules, video, audio with all the modules and Pilot questionnaire which can be completed and sent for feedback.



#### The guide for teachers "How to use L-Pack course"

**Course of Czech language:** Modul 1, Modul 2, Modul 3, Modul 4, Modul 5, Modul 6, Modul 7, Modul 8, Modul 9, Modul 10, Modul 11, Modul 12

Video (Modul 1, Modul 2, Modul 3, Modul 4, Modul 5, Modul 6, Modul 7, Modul 8, Modul 9, Modul 10, Modul 11, Modul 12)

Audio (Modul 1, Modul 2, Modul 3, Modul 4, Modul 5, Modul 6, Modul 7, Modul 8, Modul 9, Modul 10, Modul 11, Modul 12)

**Pronunciation** (Modul 1, Modul 2, Modul 3, Modul 4, Modul 5, Modul 6, Modul 7, Modul 8, Modul 9, Modul 10, Modul 11, Modul 12)

Pilot questionnaire

## Figure 3. The L-Pack WWW Sites

Source: http://www.l-pack.eu/?page\_id=402&lang=cz

#### CONCLUSION

In conclusion, on the basis of feedback questionnaires and interviews analysis, it can be mentioned that L-Pack has been accepted very well by the learners and teachers in all the involved countries.

Moreover, it has been awarded with the European Language Label 2012. It is an award that encourages new initiatives in the field of teaching and learning languages, rewarding new techniques in language teaching, spreading the knowledge of their existence and thereby promoting good practice. It should also be added that the consortium has submitted a follow-up project to EACEA (The Education, Audiovisual and Culture Executive Agency) of European Commission.

#### REFERENCES

- Diecker, L., Lane, A., O'Brien, B., Kyger, F., 2009: Evaluating Video Models of Evidence-Based Instructional Practices to Enhance Teacher Learning. Teacher Education and Special Education 32 (2), SAGE Publications, 2009, pp. 180–196, ISSN: 0888-4064
- Kopecký, K., 2006: *E-learning (nejen) pro pedagogy*. HANEX, Olomouc, 2006. 130 p. ISBN: 80-85783-50-9.
- Mika, J., Mizia, C., Berka, O., 2012: *European migration and its main problems*. In: Common communication negotiation-education. Toruň, 2012, pp. 30-47. ISBN: 978-83-7780-442-1.
- Vaněk, J. 2008: *E-learning, one of the ways towards modern forms of education.* Karviná: Slezská univerzita v Opavě, 2008. 96 p. ISBN: 978-80-7248-471-3.
- Zounek, J, 2009: *E-learning-one of the forms of learning in modern society*. 1st edit. Masarykova univerzita, Brno, 2009, 161 p. ISBN: 978-80-210-5123-2.
- L-Pack: Language Pack for Migrants in Europe, available at http://www.l-pack.eu/?lang=cz, (accessed on 10 July 2013)
- L-Pack: Language Pack for Migrants in Europe, available at http://www.l-pack.eu/?page\_id=231&lang=cz, (accessed on 10 July 2013)
- L-Pack: Project. Language Pack for Migrants in Europe, available at http://www.lpack.eu/?page\_id=16, (accessed on 11 July)
- Manuals and modules. *L-Pack*, available at http://www.l-pack.eu/?page\_id= 402&lang=cz, (accessed on 4 July 2013)

## IV. DISTANCE LEARNING OF SCIENCE AND IT

## FLIPPED CLASSROOM – CHEMISTRY ON THE EDUCATIONAL PLATFORM COLLEGE OF SCIENCE

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**Abstract:** The purpose of this article is providing a short description of flip teaching and presenting flipped classroom strategy used in educational project Śniadeckich College, including materials prepared for the project in the field of chemistry and the educational platform.

Keywords: flip teaching, flipped classroom, platform, chemistry

#### **INTRODUCTION**

**Flip teaching -** also known as **flipping the classroom, backwards classroom, reverse instruction** and **reverse teaching** – is a form of blended learning in which students work on problem on-line, watching films and animation and then learn with other students in class. This approach allows teachers to spend more time interacting with students instead of lecturing (Barseghian 2011), (Heussner 2013).

Whereas the traditional pattern of teaching has been to assign students to read textbooks and work on problem sets outside school, while listening to lectures and taking test in class. In **reverse teaching** the students first study the topic by themselves, typically using on-line lesson, which can be prepared by the teacher or third parties - an example is the Khan Academy (Toppo 2011). Classroom time is intended for the students to apply the knowledge by solving problems and doing practical work (Pink 2010).

To sum up: the essence of flip teaching is a pre-active organization of data in the process of an independent collection of information, and the search for references in students' current knowledge. Students use their prior knowledge, search their memory for information and experiences that will enable them to understand new

material and give it a meaning. Learners are trying to build a bridge between prior knowledge and material that they are to master (Figure 1).



Figure 1. Timeline – The chosen elements of flip teaching

Source: author's materials

Khan's model were originally created for one-to-one tutoring. Khan Academy videos are used as part of some educators flipped teaching strategy.

Besides mentioned http://www.khanacademy.org/ other materials that can be used while implementing flipped classroom method:

- http://ocw.mit.edu/courses
- http://techtv.mit.edu

# FLIP TEACHING GOOD PRACTICE EXAMPLES - *FLIPPED CLASSROOM* AROUND THE WORLD

"Five years ago, in the shadow of Colorado's Pike's Peak, veteran Woodland Park High School chemistry teachers Jonathan Bergmann and Aaron Sams stumbled onto an idea. Struggling to find the time to reteach lessons for absent students, they plunked down \$50, bought software that allowed them to record and annotate lessons, and posted them online. Absent students appreciated the opportunity to see what they missed. But, surprisingly, so did students who hadn't missed class. They, too, used the online material, mostly to review and reinforce classroom lessons. And, soon, Bergmann and Sams realized they had the opportunity to radically rethink how they used class time. It's called "the flipped classroom." While there is no one model, the core idea is to flip the common instructional approach: With teacher-created videos and interactive lessons, instruction that used to occur in class is now accessed at home, in advance of class. Class becomes the place to work through problems, advance concepts, and engage in collaborative learning. Most importantly, all aspects of instruction can be rethought to best maximize the scarcest learning resource—time. Flipped classroom teachers almost universally agree that it's not the instructional videos on their own, but how they are integrated into an overall approach, that makes the difference. In his classes, Bergmann says, students can't just "watch the video and be done with it." He checks their notes and requires each student to come to class with a question (Trucker 2012).

The Flipped Classroom isn't for everyone, but it's been well received by Math and Biology students and their parents at Okanagan Mission Secondary School (OKM) in Kelowna, B.C., and was strongly supported by the OKM principal, Scott Mclean. As teacher Graham Johnson noted in his personal account of his first year using the Flipped Classroom approach to learning, the feedback he has received from students and parents has been "overwhelmingly positive." Carolyn Durley, OKM Biology teacher, says she has had no negative feedback from parents. Both teachers experienced student pushback in the early days of introducing the Flipped Classroom approach, which puts students largely in command of their day-to-day learning. Principal Mclean said he views the Flipped Classroom as "a potential game-changer" because learning takes place before the student enters the classroom, allowing the teacher "to broaden and deepen" the learning. He added that it's the way learning should be for kids because they take control of their learning and they can work at their own pace (Pearson 2012).

## FLIPPED CLASSROOM IN POLAND

The inspiration to create a flipped classroom strategy were the largest education fair - Bett Show held in 2008 in London, where a delegation from the National Foundation for Computer Education had the opportunity to participate in the lessons of history at the local high school, conducted with the use of a learning platform. In 2010, the Department Pedeutology Team led by prof. S. Dylak a prepared flipped classroom strategy (Dylak, Duda 2011).

From 2010 until 2013 National Foundation for Computer Education and Adam Mickiewicz University in Poznan implemented project "Śniadeckich College - an innovative science curriculum" co-financed by the European Union under the European Social Fund 'Man - The Best Investment ".

The aim of the project was to develop, test and spread methods of education, which a team of experts described as "a flipped classroom strategy".

The pilot implementation of the strategy was attended by 200 students from the schools: St. Mary Magdalene High School in Poznan and Juliusz Słowacki High School in Grodzisk Wielkopolski.

## EDUCATIONAL PLATFORM – COLLEGE OF SCIENCE

College of Science educational platform was created for the implementation of innovative science curriculum within the Śniadeckich College project as a tool for digital approach to learning. It is available at http://platforma.wiedzatech.eu/. Educational platform for students and teachers support the learning process using flip learning in the first years of secondary school (Figure 2).

According to the concept of flip learning platform the College of Science supports teachers' and students' work to facilitate advance preparation for the lesson under teacher's lead.



Figure 2. College of Science Platform – start website (Information about the project, 'Do you know?'– strategy 'For whom?', 'Hello', choice of the subject: math, physics, chemistry, biology, geography)

#### Source: Platform

Platform's graphic design has been developed in accordance with the trends for the web and mobile solutions using the tiled navigation and info graphs for quick retrieval of content.

The scientific content available on the platform was developed by a team consisting of employees of A. Mickiewicz University in Poznan, teachers and high school students participating in the project. These are educational materials for students and teachers, for 75 topics from five subjects in the field of science: biology, geography, physics, chemistry, and mathematics (Figure 3).



**Figure 3. College of Science platform – subject materials** (Topics' examples: Biology: 'Gene, which cures', Chemistry: 'You have to eat to live', Physics: 'Zero gravity', Geography: 'The reasons and outcomes of great migrations', Math: 'From a percent to bank deposits')

#### Source: author's materials

The materials include almost all of the curriculum that is taught in the first grade of high school. Each topic on the platform is divided into four stages (Figure 4):

#### ACTIVATION

The essence of working at this stage is to activate student's prior knowledge of the topic.

#### PROCESSING

At this stage, the students solve specific tasks related to a topic based on a variety of teaching materials. Before moving to systematization step students take a screening test.

#### SYSTEMATIZATION

This step is carried out in the presence of the teacher, at this stage students organize the information obtained in the previous stages.

#### **EVALUATION**

This stage is designed to shape students' belief that the answers to the questions always create new questions and that the knowledge is never final (Dylak 2012).

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> Chemia_2_Nauczyciel_1Aktywacja_ScenariuszLekcji.pdf	28.02.2013	207	<u> </u>
PRZETWARZANIE			Strefa uczniowska
Chemia_2_Nauczyciel_2Przetwarzanie_Rozwiązania.pdf	28.02.2013	per.	
TEST KONTROLNY			→ 01/ AKTYWACJA
> Chemia_2_Nauczyciel_2Przetwarzanie_KluczTest.pdf	28.02.2013	67	→ 02/ PRZETWARZANIE
SYSTEMATYZACIA		End	→ :: TEST KONTROLNY
Chemia 2 Nauczyciel 3Systematyzaria PRE7ENTACIA.odf	28.02.2013	0	→ 03/ SYSTEMATYZACJA
Ohemia_2_Nauczyciel_3Systematyzacja_PREZENTACIA.pdf	28.02.2013	600	→ 03 SYSTEMATYZACJA → 04 EWALUACJA

#### Figure 4. College of Science platform – didactic materials

(On the left teacher's view: Activation, Processing, Test, Systematization; on the right student's view: Activation, Processing, Test, Systematization, Evaluation)

#### Source: Platform

Chemistry materials prepared in accordance with the methodological rules include **15 thematic modules, which comprise of:** 

- $\checkmark$  chemistry lesson scenarios
  - developed in accordance with the rules and provisions of flip teaching and education reform, to be implemented in the first grade of high school,
- $\checkmark$  materials for students
  - including descriptions of chemical experiments which are performed by students at home,
- ✓ methodological materials for teachers
  - including the solution of tasks and methods of their assessment (Gulińska, Bartoszewicz Makles, Mischke 2011)

#### Table 1.

Activation – materials from	ı student's and	teacher's profile
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On the platform, in the folder ACTIVATION – materials for the student		On the platform, in the folder ACTIVATION – materials for the teacher		
On the stuc ✓	platform in the catalog AIMS of lent's activities PROBLEM - a description of the problem situation activating the student to begin work on the subject KEYWORDS STUDENT'S ACTIVITIES Tasks and questions divided into mandatory and avtra	<ul> <li>lesson scenario with methodolog comments indicating the appropriate section of the curriculum and recommended literature.</li> </ul>	gy	
✓	MATERIALS			



## **EXAMPLE: STAGE I – ACTIVATION**

*Stimulating material – the proposal:* 

Imagine visiting the ruins of a medieval castle in Ogrodzieniec, lying in the Kraków-Częstochowa Upland, you came upon information:



#### In the student's eye:

An interesting way to present geography information during the chemistry class and to awake our desire to broaden our knowledge about the limestone.

#### Table 2.

Processing – materials from	student's and	teacher's	profile
-----------------------------	---------------	-----------	---------

On the platform, in the folder PROCESSING – materials for the student	On the platform, in the folder PROCESSING – materials for the teacher		
<ul> <li>AIMS of student's activities</li> <li>Lesson's CONTENT – texts with images</li> <li>STUDENT'S ACTIVITIES Tasks and questions divided into mandatory and extra.</li> <li>MOVIE refering to the lesson's topic</li> <li>Links to sample content on the Internet.</li> <li>APPENDIX – additional materials</li> </ul>	✓ Examples of tasks with their solutions		
Chemia CÔC Wszechobecna krzemionka	Chemia COO2 Temat 1 Wszechobecna krzemionka		
Strefa uczniowska → u/ AKTYWACJA V co: DRZTIWARZIANE	Materiały dydaktyczne Temat .		
<ul> <li>Wszechobecna krzemionka</li> <li>Na tym stapis, rowyny przewsześmi, majs do pradzowata koństware poleonia. Zaposaj tej z zaktarel wielistaczonym kaj dofenia prze warzyczada, i skał z zookane wieli konzerni prze wspis kolektyrum rozdani przewidy. Tezer zwarze worząsani w politika i konzerni przewszenia doływa z jej wyberzytatem i dofenia rozda pozoby. Tezer zwarze worząsani w politika i konzerni przewszenia doływa z jej wyberzytatem i dofenia for rozda pozoby. Tezer zwarze worząsani w politika i konzerni przewszenia doływa z jej wyberzytatem i dofenia for rozda pozoby. Tezer zwarze worząsani w politika i konzerni przewszenia doływa z jej wyberzytatem i dowa dofenia rozda pozoby. Tezer zwarze worząsani w politika i konzerni przewszenia doływa z jej wyberzytatem i dofenia for rozda pozoby. Tezer zwarze worząsani w politika i konzerni przewszenia dowa z jej wyberzytatem i dowa dofenia jej w rozda pozoby. Tezer zwarze worząsani w politika i konzerni przewszenia dowa z jej w rozda pozoby. Tezer zwarze w politika i konzerni przewszenia dowa z jej w rozda pozoby. Tezer zwarze w politika i konzerni przewszenia dowa z jej w rozda politika i konzerni przewszenia w politika i konzerni politika i konzer</li></ul>	PRZETWARZANIE         20 A22 013           > Chemia J. Huuczycki ZPrzetwarzunie Boowięzania pdf         20 A22 013		
edulacyjnej – na presječe tego etapo maz 4 dni (9 opdini) i nie powinno Ci to zająć więcej niż 60 minut.			
Zadanie VIII. Uzupakij zbarnat dorazvijev odmiany w jakich występuje izramioska, wrtawiając naztępujęca wyrazy trydymit, krystawi bedzawnos, odmiany krystakizne, krystaki zakawione, krystakia, odmiany bezpostacione, kwar.	Chemia Lekeja I. Wazechobecna krzemioska		
Krzemioska	Charakterystyka przetwarzania jako drugiego etapu kształcenia wyprzedzającego Sukcesywne umieszczanie na platformie materiałów, zadań, opisów doświadczeń, testu oraz kontrola postępów uczniów. Uczeń pracuje samodzielnie, wyprzedzając lekcje. Nauczycieł bierze utażał w dyskurjach na forum oraz udziela na czacie konsultacji (o wyznaczonej godzinie); sprawdza, jak uczniowie wykonali zadania (przygotowali odpowiedzi na pytania – zazanjami is z materiałem), udostępnia opisy doświadczeń (SSC/1.1) i na końcu pytania testowe (na platformie).		
Linki do stron internetowych uzupełniających lekcję Diłeck Intrus - odniany, mierały, kramioka, zapatenia (sylca płu), zatozowanie (skło fiwaczwe, złkażd, estawie): Lik w 1 Lik w 2 Sky, móznie, skłod istodnian, występowanie w fekce (ska dostrzew do powytrzych leków - stepad 2012 c) Do pobrania	a) Cele działania uczniów W wyniku samodziełnych poszukiwań uczeń powinien wiedzieć: czym jest krzemionka,		

Additional materials essentials at this stage:

✓ Chemistry in a small scale laboratory set

#### In the student's eye:

Majority of us at this stage of the work before the lesson liked the most. Experiments are always exciting for us. And by the way it turned out as many reagents is available around us.

#### In the practician's eye:

An experiment in the chemistry teaching is a very important and valuable tool for working with students: among others, it increases interest in the subject and involves different types of student's activity (Figure 5).

An example of the task on the educational platform



Figure 5. College of Science platform – interactive task

(Buttons i.e. 1+2 allow to simulate conducting an experiment. Student's task is to indentify substances needed and putting their names under test tubes)

### Source: Platform

#### In the student's eye:

Without any problems we were able to identify the tubes 3, 4 and 5 But we were confused because of the information about the red-colored mixture of 1+4.

We would arrive at a solution easier if given data mentioned the raspberry color.

- film available on the platform
- e-portfolio

## In the practician's eye:

Students as a result of independent research, sometimes after the consultation with the teacher or discussion between students, created their e-portfolio sites on the platform. Teacher while checking student's work have the ability to edit the text in order to correct mistakes, highlighting them in a different color.

#### Table 3.

On the platform, in the folder TEST –	On the platform, in the folder	
materials for the student	TEST – materials for the teacher	
✓ TEST with 10 questions	• TEST with the solution	

#### Test – materials from student's and teacher's profile.

Chemia Coo 2 Coo Coo	Chemia Coo Wszechobecna krzemionka
Materialy dydaktyczne Temat	Materiały dydaktyczne 🛛 🔹
	TEST KONTROLNY
TEST KONTROLNY	> Chemia_1_Nauczyciel_2Przetwarzanie_KluczTest.pdf 28.02.2013
Test 1	Poprawne odpowiedzi do testu kontrolnego
Przygotowanie testu sprawdzającego wiedzę uczniów na temat krzemionki.	Nr zad. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.
<ol> <li>Jaki charakter chemiczny ma tlenek krzemu(IV)? Zaznacz prawidłową odpowiedź.</li> <li>Zaznacz prawidłową.</li> </ol>	Odp.         b)         a)         b)         d)         c)         c)         d)         b)         a)         c)
a) Zasadowy b) Kwasowy	
c) Amfoteryczny	
d) Obojętny	
<ol> <li>Jak nazywa się najpopulamiejsza odmiana krystaliczna krzemionki? Zaznacz prawidłową odpowiedź.</li> </ol>	
Jak nazywa się najpopulamiejsza odmiana krystaliczna krzemionki? Zaznacz prawidłową odpowiedź:     a) Kwarc	
2. Jak nazywa się najpopulamiejsza odmiana krystaliczna krzemionki? Zaznacz prawidłową odpowiedź:     a) Kwarc     katort     katort     katort	

#### In the student's eye:

Most of us complained about the large number of tasks that needed to be solved before taking the test. Fortunately, some of these tasks were not difficult.

### In the practician's eye:

To effectively discuss the results of the test is teacher should prepare a table presenting the effects of students' work.

#### Table 4.

Systematization - materials from student's and teacher's profile

	On the platform, in the folder SYSTEMATIZATION – materials for the student	SYST	On the platform, in the folder TEMATIZATION – materials for the teacher
✓	AIMS of student's activities	✓ ;	Systematizating presentation
~	Homework	(	corresponding to the test


#### Table 5.

# Evaluation – materials from student's and teacher's profile

On the platform, in the folder EVALUATION – materials for the student	On the platform, in the folder EVALUATION – materials for the teacher
<ul> <li>EVALUATION QUESTIONNAIRE</li> <li>OPEN OR CLOSED QUESTIONS</li> <li>PREPARED FOR THE ATTENTION OF</li> <li>STUDENTS AND TEACHERS</li> </ul>	✓ There is no folder EVALUATION for teachers.
Chemia COO Viszechobecna krzemionka	
wykonania poszczególnych zadań: 0 1 2 3 4 5 6	

By accessing the platform, students after login, have the ability to solve problems on the basis of available teaching materials and the process of preparation for lesson is monitored and controlled by the teacher (Figure 6).



Figure 6. College of Science platform – Login

Source: Platform

All materials collected during the search student can save in My notebook (figure 7.), which is a module for collecting notes (text, files, web sites) for later use.

> Portfolio	🍨 Mój notatnik	
> Tematy	B ✓ U 44 E 3 3 B Syles - Paragaph - E E E # B @ (*) (*) = ⊕ U 2 3 @ ma	
> Kalendarz	<u>- 2 m x x Ω</u>	
> Forum		
> Ogłoszenia		Zapisz
Moj NOTATNIK Wejdz 5	Wybierz (wysierz piłk) Ne wybrano piłku Nazwe piłk Adres w Ne wybrano piłku Nezwa alect Wybiełdana	Zapisz Zapisz
	Brak dodanych plików lub hiperłączy.	

**Figure 7. College of Science platform – My notebook** Source: Platform

The platform allows to organize work's calendars for students and teachers (Figure 8). Calendar module presents lessons available in a given school year divided into stages: ACTIVIZATION, PROCESSING, TEST, SYSTEMATIZATION, EVALUATION.

	Kolegiu przyrodni	<b>IM</b> cze	÷.	Zalogowana(y):	Uczen01 Uc.	zen   Zmień F	iasło	<sup>Pobrekujese pomoci Wyloguj &gt;</sup>
Klasa 1 Terrat 8: Przetwarzanie Klasa 1 Terrat 11: Przetwarzanie	> Portfolio		1	< <b>K</b> r Przedmiot Che	wiecień <sup>mia</sup>	2013	>	
Zmień ustawienia:	> Tematy	Pon	Wt	Śr	Czw	Pt	Sob	Nd
Terrar: Przyczyny i skutki globalizacji Klasa: Klasa 1 Terrar: 20-23.02.2013	> Kalendarz		2	3	4	5	6	7
Edvisi termin Systematyzaci. > Zmen dkootć starotv. > Zobacz szczentki termite.	> Forum			Temat 12		Temat 12: I	Przetwarzanie	

Figure 8. College of Science platform- calendar Source: Platform

The teacher has the ability to edit the dates of stages, change their length, to see details of the subject in the calendar. Students work in accordance with the described methodology and place their work place in the portfolio (Figure 9).

Kolegium przyrodnicze	> Zalogowana(y): Uczen01 Uczen II Zmień hasło	Potrzebujesz pomocy? Wyloguj >
Pamiętaj: używoj postolka, jako najważniejszego miejsca w knórym użbiecnas dane do temanu	Chemia Coo Coo Coo Coo Coo Coo Coo Coo Coo Co	
<ul> <li>Portfolio</li> </ul>	B / U 444	
> Tematy		
> Kalendarz		
x		Zapisz

**Figure 9. College of Science platform – Portfolio** Source: Platform

The teacher obtains the ability to monitor, organize and support the work of the students and he or she can publish his or her own teaching materials on the platform. The platform also allows the verification of the achievements of the students and their reporting. It has functionalities such as class notice board or discussion forums which is moderated by the teacher (Figure 10). All users defined in the system are able to upload materials which visible to everyone.

	Portfolio	🔄 Ogłoszenia	Mind providence 👘 🔹 Pokaz
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		Zapisywanie i przekształcanie wyrażeń algebraicznych	Zapisywanie i przekształcanie wyrażeń algebraicznych
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**Figure 10. College of Science platform – Notice board** Source: Platform

# CONCLUSION

Teaching chemistry took place before the traditional lesson. Students using the platform prepared for classes according to the teacher's instructions, allowed them to discuss the topic in schools in a problem and multi-contextual way.



Figure 11. Results of teachers' surveys

## Source: Platform

Learning through educational platform may occur at any time and in any place, allowing for the development of the student, not only in terms of the class-lesson system, but also enables to develop the interest in the subject beyond the typical school area. Collected during the pilot implementation of the data and the opinions of teachers who were involved in the project, show that students working using flipped classroom strategy were more efficient at problem solving and understanding of the discussed issues (Figure 11).

# REFERENCES

- Barseghian, T., 2011: Three Trends That Define the Future of Teaching and Learning, MindShift, KQED available at http://blogs.kqed.org/mindshift/2011 /02/three-trends-that-define-the-future-of-teaching-and-learning, (accessed on 1 August 2013)
- Dylak, S., Duda, L., 2011: The implementation strategy of Collegium Sniadeckich, Poznan
- Dylak, S., 2013: Methods of training in flip teaching strategy, collective work, a text book co-funded by the European Union under the European Social Fund, Poznan ISBN 83-918407-6-X

- Gulinska, H., Bartoszewicz, M., Makles, G., Mischke, K., 2011: Scenarios for Chemistry classes in line with flip teaching – Collegium Śniadeckich, Department of Chemical Education, Poznan
- Heussner, K. M., 2013: Clay Christensen takes closer look at how online learning will disrupt K-12 education available at http://gigaom.com/2013/05/23/clay-christensen-takes-closer-look-at-howonline-learning-will-disrupt-k-12-education, (accessed on 1 August 2013)
- Kolegium Śniadeckich: *About the Project, 2012,* available at www.kolegiumsniadeckich.pl and www.ofek.pl. (Accessed on 10 February 2013)
- Pink, G., 2010: *Think Tank: Flip-thinking the new buzz word sweeping the US*, The Daily Telegraph
- Toppo, G., 2011: Flipped' classrooms take advantage of technology, USA TODAY

# THEORETICAL AND PRACTICAL ASPECTS OF COMPUTER COURSE "INFORMATION TECHNOLOGY" FOR BLENDED LEARNING OF FUTURE ECONOMISTS

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Abstract: This article contains the analyzed conception of blended learning and peculiarity of blended learning process in higher school. There is an example of computerized learning system in higher school on basis of Moodle; main aims of the Information technology course in economical type of schools have been studied. Some difficulties which students are faced with while taking the course, as well as reasons of low educational level in computer science are mentioned. Driving forces for educational activities of students have been investigated; distinguished descriptions of methodical learning systems in using the information communicative technologies have been made; it is examined the structure of computer course for future economists and its use in learning process on the basis of Moodle 2.5 based on the principles of blended learning has been examined.

**Keywords:** blended learning, model of blended learning process, system e-learning in higher school, computerized learning course, Moodle

## **INTRODUCTION**

Information technology science today plays an exceptional role in future specialist training in the field of mathematics, computer and informative technology, production, economics and management. It is also very important for formation of definite informative standards, intellectual development as well as scientific conception of the world, in comprehension of applied trend of information technology.

Information technology science and communicational technology today are inalienable parts of human culture. They are the keys for knowledge of the surrounding world with the use of computers and informational technologies; they are important components of personality development. Therefore every person has their rights for high quality informative education and it's obligatory for every society to give the opportunity to get it.

With the civilization development the role of computer science and its methods is constantly increasing. The interrelation of computer science into other sciences is getting more significant. Informational technologies today are the powerful instrument in difficult problems solutions, which appear in different spheres of human (commercial) activities. The gradual process of computerization of science and production will continue. In connection with it, there appear major alterations in qualifying requirements of future specialists in any sphere, especially in production, economics, finance and management.

Therefore problem investigations, which appear nowadays in computer training of future economists education in higher schools and finding their solution is an urgent social goal.

One way for increasing quality level in computer science training for future economists today is the use of innovative educational technologies, particularly a blended learning.

In this article are examined theoretical and practical aspects of applying blended learning approach in future economic specialists training on the example of the authorized computer course *Information Technology*, accomplished in computerized learning system in higher school on the basis of CLMS Moodle 2.5, that gives the opportunity to increase the efficiency of learning process and provides better quality of specialists professional training and forms their IT-competence.

# 1. BLENDED LEARNING AS AN INNOVATIVE EDUCATIONAL TECHNOLOGY IN HIGHER SCHOOL EDUCATION

The fast development of information technologies makes changes in almost all spheres of human activities, and education takes one of the first places among them to introduce innovations on the basis of information communicative technologies.

The notion of online training is attached fast in students' minds today. The internet becomes largely an educational space, which provides modern students with better opportunities of getting to informational database and of teamwork. New educational approaches like distant-learning, electronic learning, mobile-learning, online learning and blended learning develop fast (see examples Adams 2008, Blended\_learning, E-learning, M-learning, Online Nation). But specialists suggest exactly blended learning is one of the most perspective innovation trend in higher school.

In the research work (Tryus 2012) the concept of blended learning process is analyzed in details. Therefore we give here only basic principles, of which the use of the blended learning approach in authors professional activity consists.

Blended learning is aimed first of all at learning and professional requirements of every participant of the learning process. While in traditional learning system a general knowledge level is expected from all present students in class. A lesson has got an only usual scheme, individual qualifications are mostly not taken into account the blended learning system provides everyone the opportunity to choose the rate of mastering as well as priorities in learning themselves. Blended learning is useful for those students, who in case of different circumstances cannot be present at the lectures in their higher school (because of health problems, family circumstances, occasionally employment or permanent work, especially for senior, graduate students) and for those, whose profession demands durable business trips and missions, that means durable absence from the town, where the higher school is.

In the principles of blended learning the learning process includes job-retraining and qualification raising of specialists and studying to get a post-graduate degree. So graduates, who have got a bachelor's degree, can get a master's degree in the field they work, without discontinuing work. Learning programs like these are widely used in German and British universities. In several European countries universities offer some modules which are taught simultaneously in traditional way for present in class students and for distant ones so they won't feel left alone. Blended learning gives opportunities to students to go on learning at universities in European countries.

In contemporary educational literature sources you may find different explanations to the concept of blended learning (Collis 2001, Musiyovska 2013, Heinze 2013, Koval 2008).

According to one of them, *"blended learning is a purposive process of getting knowledge, experience and skills. It is learning of methods for education and personality development, obtaining of creative abilities by complex and systematic application of the traditional and innovative pedagogical technologies and informative-communicative learning technologies to complement one another with the aim to get the better quality of education"* (Tryus 2012). We will use it in the context of our study.

# 2. PECULIARITIES IN ORGANIZATION OF BLENDED LEARNING IN HIGHER SCHOOL EDUCATIONAL PROCESS

As it is mentioned above, the tendency in organization of the educational process in higher school develops toward blended learning process, which combines traditional as well as computerized methods, forms and means in its organization.

As a rule, blended learning consists of following stages (Tryus 2012):

individual students' work on the theoretical material using distant, electronic and mobile technologies;

- learning practical skills in form of traditional class lessons using innovative pedagogical technologies;
- discussing difficulties on the internet in online or off-line mode using distant, electronic and mobile technologies;
- monitoring and executing control as well as scoring students' educational achievements using computerized test programs, especially doing a computer test;
- execution of final test in discipline (examination test) and presentation of student's qualification project in traditional full-time form.

Blended learning model is a type of using informational educational resources in traditional learning with applying of the elements of asynchronous and simultaneous distant and mobile learning. Blended learning in higher school is recommended as a part of traditional learning in class lessons. The aim of blended learning is to combine the advantages of traditional and distant learning and to reduce their defects.

The main problem in introduction of blended learning in higher school is the low rate of self-management and self-control of learning students. If they are too low, the learning material won't be learned well enough and will influence the education quality. Therefore purposive work on the development of student's self-educated skills and getting knowledge, making them communicative and cooperative in teamwork are not less important aims in learning process and forming their informative and communicative competences.

For realization of blended learning process technology in higher school computerized learning systems are mostly used. One of the most widespread systems of this type is Moodle (Modular Object Oriented Distance Learning Environment) (Website learning management system Moodle, Smirnova-Trybulska 2007).

Here we observe an example of electronic learning in higher school, in which one of the authors participated.

## 3. SYSTEM E-LEARNING FOR HIGHER SCHOOL ON THE BASIS OF MOODLE

Cherkasy State Technological University has created an e-learning system on the basis of Moodle 1.9. It is intended for learning process support of full-time, distant and external students, for management of their individual work and for monitoring and executing control and assessment of students' educational achievements in automated mode.

System e-learning of Cherkasy State Technological University is made accessible to all students and teacher staff and administration of the higher school according to the

rights of access to the information resources and its subsystems (E-Learning System CSTU).

For blended learning's successful software support, monitoring and assessment in System e-learning of Cherkassy State Technological University is created its full elements structure. It includes course structure, course scheduling, course curriculum, initial control, course modules, accounting-graphic and projects database, final test and general knowledge assessment tasks. Each module has its organization structure of the course.

Learning process organization in system e-learning is connected with individual task completion, examination, computerized questionnaire, discussions on Internet forums and chat.

On the basis of system e-learning is made an electronic assessment register, that includes necessary information about the course.

The qualification project (Tryus 2012) describes in details the system e-learning in higher school on the basis of Moodle 1.9 and its peculiarities in use for all types of education in learning process management.

# 4. LEARNING PROBLEMS AND SOME WAYS OF THEIR SOLUTIONS FOR FUTURE ECONOMISTS

There are some learning aspects of information technology study for economists in higher school of Ukraine.

The research analyze proved, that the main aims of information technology study in higher educational institutions today are:

- formation of students personality, development of their intellectual ability, analytic and synthetic thinking and intuition;
- learning of computer scientific hardware, which is necessary for learning professional disciplines, development skills for cognizant perception of learning material from different information sources for appropriate profession;
- learning methods, necessary for process analysis and modeling phenomena, which appear in social, economical, technical, production and information schemes; searching for optimal decisions to gain better production efficiency, and choosing the best way of implementation of these decisions, processing and analyzing the results of these calculating experiments;
- to form a satisfactory qualification level of graduate students for future professional occupation, further self-education skills in information technology science, research work with an application of up-to-date achievements in information technology;

- to form components of information culture, which are connected with the future professional occupation in the informative society.

The research of information technology training for economists in some higher schools in Chernivtsi and Cherkasy proved, that students' learning achievements and information culture level do not correspond with the needs of the modern information society. All this can make a negative influence on the students' qualification quality and qualification skills.

As the result research, students say, that the significant reasons are the low level of information technology training at school (75,41% and 44,78% correspondingly), inability and unwillingness of students to learn individually (54,10% and 38,81% correspondingly).

Among the ways of their solution, which exist in higher school and in information technology training today, the key position is the intensification of learning-perceptional activity of students while doing information technology training course on the basis of wide use of pedagogical and information-communicative technologies (see, example, Tryus 2005).

The purposeful work of information technology teachers in forming and development of cognitive activity of their students leads to increasing their competence and thinking development. Significant didactic potentialities for increasing of quality of learning-perceptional activity of their students are connected with the use of modern informative-communicative technologies.

The increase of students' educational level in information technology course, intensification of their learning and perceptional activity, the answer to other mentioned problems in learning can be provided by introduction of a methodical system in information technology with the wide use of innovative pedagogical and informative-communicative technologies. This methodical system became *computer guided methodical training system* ,,that will provide the purposeful process of obtaining knowledge, skills and methods in learning and perceptional activity of students, development of their creative abilities on the basis of information technology in use'' (Tryus 2005).

The authors do a scientific research of completion computer guided methodical training system for information technology training for economic and finance students. (Yatsko 2012, 2011).

On the basis of this research authors have created a computer guided learning system in information technology training for future economists and called it *Information technology* training course, that is implemented into learning process in Bukovyna State University of Finance and Economics.

# 5. COURSE SPECIFICATION OF DISCIPLINE *INFORMATION TECHNOLOGY* FOR ECONOMIST STUDENTS

The aim of *Information technology* course for economist students is to gain theoretical knowledge and study the principles of modern and perspective software systems and networks, knowledge of system and applied software, as well as professionally peculiar purposeful software to meet the requirements of economic activity (Yatsko 2011).

Learning tasks of *Information technology* course are gaining theoretical knowledge in information technology and computer science, technological providing of computer systems and networks, algorithmization and programming, modeling of economic processes, automatic management systems and economic data processing. In addition to all students have to form their skills in practical application of their knowledge of information communicative technologies in professional purposeful tasks in economics and finance.

One of the leading tasks in organization of learning discipline is combination of its theoretical and practical aspects. Hereby the practical aspect is connected with gaining of practical skills in work with the prepared software for common and special use, as well as ability of mastering simple programs with the use of one of high level programming languages.

The training course is divided into three learning modules (Yatsko 2011).

The first module is *"Theoretical basis of economic information technology and computer technics*". It considers the history of computer, computer science and information technology, basic concepts of information systems and their qualification. The module also includes the peculiarities of application of technology systems in economics, the role of communicative technologies in rising of competitiveness of enterprises. Students study the role of computer technology in economics, the perspective of use of applied data processing systems in economics for solving business cases. The basic concepts of information modeling of information environment, their historical stages of development are introduced. The module includes information about structural elements of business information systems, hardware and software support, word processing programs, presentation creating systems, spreadsheets, computer networks and their use in economics. The notions of concepts of e-commerce, e-business, methods of Internet trading and Internet marketing, transactions on the Internet and Internet-banking are revealed.

The second module is "*The information technologies for solving economic tasks*". It considers methods of information security, databases, their control systems and functionality, methods of data selection by request, use of forms in making user's interface, basic web design and object-oriented programming.

The third module is "*Perspectives of development in information technology and computer systems*". It considers the possible ways of improvement in computer and communication technics, perspective technologies in data storage and transmission,

use of calculation in small business. Students study the methods of evolution modeling in economics, the use of obscure models and methods of making decisions in information-analytical control systems. The module covers modern mathematical systems in data processing, artificial intelligence systems, expert systems and their use in economics and business. It deals with a role of mathematical logic application, with the use of logical models in expert systems, with monitoring strategies and solving collisions. Students get acquainted with perspectives of use of Internet in commerce and business, modern information systems in economics and of use of artificial neuronal networks in commerce.

# 6. ELECTRONIC TRAINING COURSE *INFORMATION TECHNOLOGY* FOR FUTURE ECONOMISTS

For study of the discipline *Information technology* based on blended learning principles approach, represented in authors' work (Tryus 2012), on the basis of Moodle 2.5 there was completed a training course *Information technology* (The system of e-learning department of computer science BSFEU) (Figure 1, 2).



# Figure 1. The main window of electronic learning system of computer science department of BSFEU

The Moodle 2.5 provides LMS (Learning Management System), CMS (Content Management System) and VLE (Virtual Learning Environment). Therefore it can be

useful in all stages of scheduling and realization of the learning process and meets all the requirements of this type of systems (Virtual Learning Environment).

Detailed information about Moodle 2.5 and its functionalities you can find on the website of this system using the link (Moodle 2.5.1 release notes, New features Moodle 2.5.1).

Electronic training course Information technology has the following structure:

- 1. General course characteristics:
  - a course news;
  - goals and tasks of the course;
  - a study program;
  - a course structure;
  - a schedule of the course;
  - types of control and criteria of assessment of students' learning activity during the course;
  - a list of printing works and informational resources of the course;
  - a list of useful software of the course;
  - a glossary of the course.
- 2. Entrance control of the course:
  - questions and tasks for the entrance control;
  - a list of disciplines with a necessary learning material;
  - an entrance test
- 3. Theoretical learning material of the training course (contains abstracts from lectures and presentations).
- 4. Materials for practical training:
  - program catalogue;
  - methodical guidance to practical classes
- 5. Individual students' work:
  - methodical guidance for learning theoretical material for individual work;
  - tasks for individual work;
- 6. Current, topical and attendance control:
  - lecture attendance control;
  - practical classes attendance control;
  - current control;
  - individual and practical task reports;

- module control;
- module tests;
- topics for essays and abstracts;
- creating and presentation of students' projects;
- 7. Module control:
  - questions and typical tasks for control;
  - module test;
  - module test results;
- 8. Semester course control:
  - questions and typical tasks for semester test;
  - semester examination test results in the discipline;
  - summing up form of *Information technology* course;
  - summing up questionnaire of *Information technology* course;
- 9. Knowledge storage control:
  - questions and typical tasks for knowledge storage control;
  - test of knowledge storage control;
  - results of knowledge storage control.

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#### Figure 2. Main page of electronic training course Information technology

To create the electronic *Information technology* course on the basis of Moodle 2.5 were used the following types of:

- activities: database, glossary, task, test, lesson, forum;

- resources: book; inscription, folder, page, link.

For successful learning of theoretical and practical material students must do some tasks. Namely for learning theoretical material we use such type of activity of Moodle 2.5 as a lesson. After students have finished listening to the lecturer, have watched multimedia (MMVF) or presentation they have to revise the lecture material on the PC from the *Information technology* electronic course once again (Figure 3). Computer training program contains on each page a fragment of theoretical material of a lecture and students should complete the test (Figure 4) to move on the next page.

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# Figure 3. Start page of an electronic lecture



Figure 4. Fragment of an electronic lecture

Before students start working at practical tasks, a teacher prepares an oral test and a computerized test in the system Moodle 2.5 to activate students' gained knowledge. Students send all the results and reports to electronic learning systems database. All types of students' learning activities in electronic learning system *Information technology* can be checked and students get marks for each type of activity and final mark at the end of the module, which will be stored in electronic register. This gives students a possibility to observe their educational achievements and encourages them to make progress.

# CONCLUSION

To sum up all the possible ways to overcome negative tendencies in educational information technology training for future economists and perspectives of its development the following conclusion is made:

1. We should introduce corresponding learning programs of information technology course at school and in higher school, update the information technology training course at higher school, fill it content up with information about modern achievements in computer science, innovative informative and communicative technologies, especially in economics, and improve the level of basic theoretical support in computer science.

2. Purposeful way of learning process improvement is creation and adoption in higher school computer based methodical training systems in information technology course on the basis of innovative pedagogical and informative communicational technologies. (technology web-2.0, technology of electronic, distant and mobile learning, social networks).

3. Every higher educational institution has to create an educational-scientific informative environment, which will provide the successful use of information communicative technology according to the blended learning model in traditional and distant lessons, especially lectures, practical classes, laboratory classes, tests, research work management and individual work of full-time and external students.

# REFERENCES

- Adams, J., 2013: *E-learning offer myriad opportunities for rapid talent development*, available at http://yellowedge.files.wordpress.com/2008/03/ adams.pdf, (accessed on 28 July 2013)
- Blended\_learning, available at http://en.wikipedia.org/wiki/Blended\_learning, (accessed on 28 July 2013)
- Collis, B., Flexible, 2001: Learning in a digital world: experiences and expectations. Kogan Page Limited, London, 231 p.

- E-Learning System CSTU, available at http://ias.cdtu.edu.ua, (accessed on 28 July 2013)
- E-learning, available at http://en.wikipedia.org/wiki/E-learning, (accessed on 28 July 2013)
- Heinze, A., Reflections., On The Use Of Blended Learning, available at http://www.ece.salford.ac.uk/proceedings/papers/ah\_04.rtf, (accessed on 28 July 2013)
- M-learning, available at http://en.wikipedia.org/wiki/M-learning, (accessed on 28 July 2013)
- Moodle\_2.5.1\_release\_notes, available at http://docs.moodle.org/dev/ Moodle\_2.5.1\_release\_notes, (accessed on 28 July 2013)
- New\_features Moodle\_2.5.1, available at http://docs.moodle.org/25/en/ New\_features, (accessed on 28 July 2013).
- Online Nation: Five Years of Growth in Online Learning, available at http://sloanconsortium.org/sites/default/files/online\_nation.pdf (accessed on 28 July 2013)
- Smirnova-Trybulska, E., 2007: Distance learning with the use of MOODLE system Publishing house Ailant, Kherson, 2007, p. 492 [In Ukrainian]
- The system of e-learning department of computer science BSFEU, available at http://www.kkd-bsfa.cv.ua/course/view.php?id=4 [In ukrainian] (accessed on 28 July 2013)
- Tryus, Y., 2005: *Computer-oriented methodology of learning math*: Monograph, Brama-Ukraine, Cherkasy, 2005, p. 400 [In Ukrainian]
- Tryus, Y., Gerasimenko I., 2012: Combined training as innovative educational technology in higher education. Theory and methods of e-learning: a collection of scientific papers, issue III, 2012, pp. 299-308 [In Ukrainian]
- Tryus, Y., Gerasimenko, I., Franchuk, M., 2012: *The system of e-learning university based on MOODLE*: Methodological manual, Cherkasy, p. 220 [In Ukrainian]
- Virtual Learning Environment, available at https://en.wikipedia.org/wiki/ Virtual\_learning\_environment (accessed on 28 July 2013)
- Website learning management system Moodle, available at www.moodle.org, (accessed on 28 July 2013)
- Yatsko, O., 2011: *E-learning course "Economic informatics" for students of financial specialties.* Innovative computer technology in the higher school: Materials of the 3rd scientific and practical conference, 2011, pp. 51-57 [In Ukrainian]

Yatsko, O., 2012: Problems in computer education of future economists and their solutions. Theory and methods of teaching mathematics, physics, computer science: a collection of scientific papers. Issue X, 2012, pp. 200-207 [In Ukrainian]

# DESIGNING AND BUILDING OF INTERACTIVE CONTENT FOR DISTANCE EDUCATION

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Abstract: Interactive elements constitute an important part of educational materials and make a significant impact on the memorization process. With the development of programming technologies, the range of interactive elements, such as games, simulations, and decision-making labyrinths that match the characteristics of the knowledge they present has significantly expanded. The article presents a review of the available technologies based on their use in creation of interactive content for distance education. The authors also present the applications of selected interactive elements in different educational contexts.

**Keywords:** interactive content, interactivity in education, e-learning technologies, authoring tools, distance education

# **INTRODUCTION**

With the development of ICT technologies, the terms *interactive* and *interaction* have gained a new context and now refer to cooperation between people and software interfaces (http://en.wikipedia.org/wiki/Interactivity). In essence, they pertain to cooperation of the programmer who develops software with the software user. The programmer is overlooked in the same way as the designer of the control panel of a car, a plane, etc. Only the software user and the machine remain; in the matters to be discussed here, they are the learner and the interactive software.

From the point of view of the programmer who develops editor software for distance learning materials, there are several types of possible interaction with software.

- A. Pressing a key that starts a part of the software;
- B. Entering a string of characters, not necessarily a real world, in an edition field;
- C. Selecting a phrase from a defined list of words;
- D. Placing the mouse arrow over a specific area of the computer screen;
- E. Indicating one of a number of verbally expressed options;
- F. Indicating many options shown on the screen and described verbally.

Of note is the fact that standard interaction (without additional hardware components) can be based only on integrated information input and output (presentation to the user) devices, such as:

- 1. The keyboard typing text, operating the arrow keys: right, left, up, down; sets of keys;
- 2. Placing the mouse arrow over a button figure, an option selection field, or an area defined by the programmer;
- 3. The monitor screen with a different number of displayed points (resolution);
- 4. Playing a digital sound with or without an image.

Cameras, motion sensors, and microphones with voice recognition are a category of devices with additional software, often non-standard and custom-made.

In the opinion of the authors, proper definition of interfaces used in interactions is of significant importance to educational applications.

# **1. INTERACTIVE CONTENT**

#### 1.1 Simulation

A simulation shows to a student a model of a problem, a phenomenon, an event that cannot be seen in the natural environment, the interior of a body, or the functionality of software that the student is learning to use. This is an A-F type of interface. The simulation is performed by the distance learner in a virtual laboratory or in connection with a stationary laboratory in the school buildings. Such simulations are widely used in medical sciences (Page, Kreutzer 2006), technical sciences, natural sciences, economics, and military sciences.

#### 1.2 Games

An educational science that implements a story that contains various educational situations that are always related to the studied matter. An example is a game involving examination of a patient or an issue related to agricultural technology or chemical technology. This is an A, B or D type of interaction. What makes this game different from other interactive elements is the scenario. It should be cohesive and

monothematic and must facilitate focusing on the learning process. Games serve three purposes: motivation, stimulation, and facilitation of understanding (Margulis 2005: 83).

#### 1.3 Action Maze

A student is presented a problem (in the form of a text or a film) and the recommended ways to solve it. E-type interface, one of the recommended options must be selected. Each selection leads to another problem which is a consequence of the selection, with new options to choose from. This is referred to as labyrinth: the learner moves between problems as if he or she was in a labyrinth, not knowing what is round the corner. E-learning materials usually have ready patterns for creating decision labyrinths, e.g. the LCDS (Learning Content Development System). Thinking through the essence of the problems and their mutual connections requires much more attention.

#### **1.4 Interfaces of self-tests**

Tests usually include single- and multiple-choice questions (in different forms) or questions where blank spaces in a text need to be filled out. The contents of questions, together with the different possible answers, are described with text and/or illustrated using multimedia techniques with various application interfaces. The IMS Global Learning Consortium, which standardizes the distance education process, has established a standard design of a questions database file and a standard for knowledge tests. At present, two Question and Test Interoperability standards are in use: the QTI 1.2 (from 2002) and the QTI 2.1 (from 2010). The 2.1 version defines as many as 19 test question structure models (Roszak, Kołodziejczak, Kowalewski, Ren-Kurc 2013).

# **2. TECHNOLOGIES**

Currently, programmers can use a number of technologies for creating interactive content; all of them comply with the standards for publication on the World Wide Web.

#### **2.1 Publishing standards**

Distance learning portals are web applications. What this means that the machine referred to as the server implements the role of a World Wide Web server (Apache, IIS and many others) and supports the programming technology in which the web site's software was developed (php, jsp, aspx, java, others). The Internet application of the website processes information on the server (prepares reports from the databases, searches for files on the server's disks). The results of the processing, prepared in the HTML format, are sent to the web browser on the remote computer used by the student. The browser interprets the formatting and prepares a user-friendly view. This process is referred to as publication of information in the WWW resources. It must be strongly emphasized that this process applies to information

formatted according to the HTML standard. Any files with information in different formats are treated in accordance with one of the following two scenarios:

Scenario 1 – the user's computer has software installed that cooperates with the web browsers (add-ons for browsers, http://en.wikipedia.org/wiki/Add-ons\_for\_Firefox), which is intended for reading a given file format (Flash, Office application documents, pdf). This software enables visualization of files sent from the server.

Scenario 2 – the file indicates that the visualization is to be performed by an application that has been automatically defined for this task by the user computer's operating system.

- 1. If such an application is on the computer and the browser is authorized to start it, the user can see the information contained in the file (most often a film or music).
- 2. If this application is not found in the operating system, the information contained in the file is not visualized and the web browser often displays a message with recommended actions (e.g. Google Chrome recommends, among others, searching through some Internet resources in order to find an appropriate application).

The scenarios of actions of publications in WWW server resources are strictly defined. All the materials edited for distance learning must be prepared for distribution from WWW server resources, i.e. they must be saved in HTML standard files. Information contained in other files (films, music, formats recorded by different applications) will be presented to the user in accordance with scenario 1 or 2. Both scenarios contain the possibility of failure on the user's computer, such as lack of applications that enable visualization of specific files. In such situations, an attempt will be made to save it on the user computer's disk. In such a case the user must be able to start a given application to visualize the information contained in this file.

E-learning materials editors always save materials in two types of files:

- 1. The entire content is saved in the native format of the editor for further edition or modification by this specific editor. Such files must always be archived.
- 2. The version for publication, i.e. the set of files compliant with the HTML standard and ready to be published on the distance learning website.

In conclusion, e-learning material editing applications very consistently comply with the applicable standards; this is why the authors recommend that authors of such materials use this type of applications. Manual preparation of correct files is a difficult process as it requires high proficiency in using the relevant standards and information processing technologies. This applies also to preparation of interactive elements according to WWW standards.

## 2.2 Review of technologies

The initial concept of data exchange on the Internet was based on a model where the client (the browser) was quite passive and its role was limited to displaying information received from servers on which applications, such as databases, were active. The outcomes of this approach were, among others, significant inactivity of the browser and the requirement that the server sends series of pages whose content was not very different than that of the previous pages. A break-through with regards to the level of effective interactivity of Internet applications was certainly the introduction of the AJAX "technology" (Anynchronous JavaScript and XML) in 2006. In essence, AJAX was not a new technology; however, it systematizes the use of several existing technologies, thus creating a new information exchange paradigm and significantly increasing the level of interactivity of client applications. The main components of AJAX are: HTML as the language of presentation together with flexible formatting enabled by the CSS style sheets, JavaScript application code language (working on the client's side), a hierarchical model of the document structure recognizable by scripts (DOM), and the XML language, with its various variants (which enables unlimited structure of data presentation). In particular, AJAX enables sending asynchronous requests to the server and ensures reloading contents of pages without a transmission with the server. There are also various libraries, such as JQuery, that can be used as a supplement of AJAX. The capabilities of AJAX are used to a significant extent among others by GoogleMaps.

The use of multimedia elements in Internet applications significantly enhances their visual level, but also enables a higher level of communication with the user. From this point of view, it is possible to use four classic technologies that enable building visually and technically powerful applications, so-called RIA (Rich Internet Application):

- Microsoft Silverlight the technology is available only in the Internet Explorer browser (it is used, among others, by the LCDS, a popular software for creating e-learning courses). Creation of application requires the Visual Net environment, where the interface is programmed in the XAML language based on the XML, and the communication is programmed in the C# language. The counterpart of Silverlight in the Linux system is Moonlight, technically a very imperfect software.
- JavaFX a free technology provided by Sun, which uses the JavaFX Script language. Its advantage, similarly to the Java language, is that it works on many platforms, not only in the popular Windows operating system.
- Adobe Flash and the associated Adobe Flex. The Flash is commercial application that enables designing application interfaces using the computer mouse and programming of interactions in the full objective ActionScript 3 language, while the free Flex Builder requires coding the entire application in that language. The Flash and the Flex are two out of the three options (the third is the HTML/AJAX) for creating applications in the Adobe AIR

(Adobe Integrated Runtime), a multi-platform environment for RIA applications.

 WebGL – a technology that introduces Internet applications onto the level of three-dimensional computer games. It is based on the OpenGL ES library and is available in web browsers through the *canvas* element of the HTML5 language and the JavaScript language.

Mobile devices (smartphones, tablets, PDA, etc.) have reached nowadays such a high a level of development that programming highly interactive applications (in particular e-learning applications) for them is possible (with some limitations) using the same technologies that are currently used on stationary devices. The systems that are currently the most popular are:

- iOS a system working on Apple smartphones and tablets;
- Android a system that works on mobile devices of different brands;
- WindowsPhone the newest of all the systems (launched in 2010), prepared by Microsoft, and currently implemented mostly on HTC, Samsung, and Nokia smartphones.

The basic limitation of mobile devices, compared to stationary ones, are less efficient processors – in practice, this limitation applies to RIA applications, which require greater hardware resources.

#### 2.3. Internet applications. Client-site interactions

The standards of file distribution through WWW servers and of visualization of the information contained in the files are strictly defined and their quick modification is not likely. Interaction in Internet applications is subject to all of those standards. Only the elements listed in items A-F (see Introduction) are implemented. The quick development of technologies, as the authors have mentioned in section 2.2, does not change the standards of WWW publication.

Of course, Internet applications are only one of many types of applications where interaction with users can be planned. Another type is the aforementioned mobile devices which offer a level of interactivity similar to that offered by stationary devices. However, this level can be significantly improved by using non-standard equipment, such as motion sensors (Kinect and Leap Motion (Kowalewski, Kołodziejczak, Roszak, Ren-Kurc 2013)). In particular, it is possible do develop an application for a mobile device (e.g. a smartphone) that connects remotely with the Kinect sensor, which sends to it data from the color camera, depth camera, and data the skeleton silhouette (see on http://channel9.msdn.com/coding4fun/kinect/Connecting-to-the-Kinect-remotelywith-the-Kinect-Service).

The new technologies are not free of shortcomings.

- 1. By definition, they are not available in the operating system of the users' computers (e.g. Android).
- 2. Sometimes they are tied to the operating system of a single device brand (e.g. Silverlight).
- 3. They are not available in equipment with low computational capacity (e.g. a smartphone).
- 4. They require correct installation by an administrator.
- 5. It is hard to find the causes of incorrect operation and, consequently, servicing of a computer becomes expensive.

# **3. DESIGNING AND BUILDING OF INTERACTIVE CONTENT**

## 3.1 Interface building

One of the most important phases of the e-learning application development process is designing a convenient and functional user interface. This phase requires strict cooperation between the author and the programmer; consequently, it is important that the author have general knowledge about the possibilities offered by the interface development tools (section 2). We will draft a scheme offered by RIA application tool, as their capacity is very extensive. In a typical situation, the interface is made from a set of several dozen ready components (buttons, scroll bars, text windows, etc.) available as lists of names, usually in English. Such components must be dragged with the mouse into the main application window and set in the appropriate location; also, the values of their parameters must be defined. This results in the creation of the interface code, usually in a language that is a variant of the XML. As an alternative, the code can be written directly, without using the computer mouse. Then each element must be assigned a code that handles an event to which it will respond. The code is written in a high-level language, e.g. C#, Java, or JavaScript. A typical way of handling an event is various actions of the mouse and the keyboard on the component.

#### **3.2 E-learning authoring tools**

All the editors of e-learning materials known to the authors were developed in order to facilitate and automate the application process within the resources of websites or simply in the resources of WWW servers. Their authors do not assume that the user knows how to use the technologies discussed in section 2. Processing of information up to the publication version is fully automated. Use of editors, however, requires passive awareness of the existence of operation standards of WWW servers and browsers. This issue is not always covered by ICT training.

Most editors work in accordance with the following pattern:

- Use the files (text, presentations, graphics, or multimedia) and process them;

- Offer to the user information organization and visualization templates to be filled with content (the available files) Record the e-learning material prepared this way for further modification;
- Automatically prepare a version of the materials for publication. This involves parts prepared using the programming technologies mentioned in items 4.1 and 2.2.

Programmers supplement editors with templates in agreement with e-learning method experts. Such templates always include numerous templates of interaction with the user. They should be put into groups and designated as interactive templates. This is a language-related problem (the authors may give different names to such sets of templates) as well as a technical problem (complete lack of relevant standards). The authors suggest that before the decision about the choice of the editor is made, it is a good idea to read the help files and find the information about the technologies used. A student for whom the materials are intended must be informed about the need to have software for visualization of the elements developed using a specific technology (section 3). As an example, the authors recommend testing:

- 1. The LCDS freeware editor. The programmers put in this application 24 information visualization templates; 10 of them are user interaction templates (templates from the Interact Play group and partly the Read group). In most templates, the Silverlight technology is used (Roszak, Kołodziejczak, Ren-Kurc, Kowalewski, Bręborowicz 2013).
- 2. The Xerte freeware editor, with an additional library Xerte Flex Compiler is a set of tools for developers working with the open-source Flex SDK to create advanced interactivity and applications for the Flash Player. Xerte Flex Compiler can create apps for iOS and Android. The programmers have developed a supplement to applications, which is intended especially for the interactive element templates.

# 4. EXAMPLES OF INTERACTIVE CONTENT

## 4.1 Simulation

## RGB digital color model – Java applet

The applet enables simulation of colors in the RGB model (Figure 1). On a black background, using a computer mouse, one can set the position of three circles, each filled with the primary colors (Red, Green, and Blue) at the intensity level of 0 -255, adjusted with the scroll bar. One can observe the color that corresponds to the total value of the RGB components. The Java applet requires installation of the Java Runtime environment on the user's computer. The applet is very easy to place in the HTML code. For the sake of computer security, editors of educational materials may not have the template for visualization of the applet installed.



Figure 1. Sample aplet

Source: http://www.jgiesen.de/ColorTheory/RGBColorApplet/ rgbcolorapplet.html

#### Electrostatics

The application, written in the *canvas* element of the HTML5 language, demonstrates electrostatic charges forming on surfaces of rubbed objects (Figure 2). Initially, both the sweater and the balloon have total electrostatic charges equal to zero. By rubbing the balloon against the sweater, one causes a flow of the electrons from the sweater onto the balloon, which produces a positive charge on the sweater. As a result, when the balloon is moved away from the sweater at a short distance, it is attracted by the sweater (Figure 3). The same experiment can be performed with two balloons. On the right hand there is an electrostatically neutral wall that one can touch with a negatively charged balloon, which causes the flow of electrons away from its surface.



Figure 2. Interaction in HTML5 Source: http://phet.colorado.edu/sims/html/balloons-and-staticelectricity/latest/balloons-and-static-electricity\_en.html



**Figure 3. A charged balloon attracted by the sweater.** Source: http://phet.colorado.edu/sims/html/balloons-and-staticelectricity/latest/balloons-and-static-electricity\_en.html

#### 4.2 Games

## The Blood Typing Game

The purpose of this game is for the user to learn to recognize the blood type and to properly perform a transfusion (Figure 4, 5, 6). There are three possible scenarios. In the first scenario, which is the most basic, technical training on abstract patients is possible. The second scenario comprises a series of various real situations where blood transfusion is necessary. This also enables gaining theoretical knowledge, while reinforcing the skills from the basic scenario. The third scenario is again

strictly technical. The game is supplemented with theoretical texts about blood types, laboratory methods of their recognition, and transfusion procedures. In particular, the user learns which blood types may be replaced with others if blood of a specific type is not available. From the technical point of view, the game is a simple 2D animation, but it enables learning correct medical practices in a short time.



# Figure 4. Animated procedure for putting collected blood into test tubes.

Source: http://www.nobelprize.org/educational/medicine/bloodtypinggame/game/



# Figure 5. A screen with a question about the blood type after an animated reaction in test tubes.

Source: http://www.nobelprize.org/educational/medicine/bloodtypinggame/game/



Figure 6. Blood transfusion procedure.

Source: http://www.nobelprize.org/educational/medicine/bloodtypinggame/game/

The lower left corner of Figure 6 shows the quantity of the required blood units necessary for a transfusion. If the list on the bottom of the screen does not contain blood of the patient's type, the student selects a substitute type.

Sort Game



Figure 7. Sort game in LCDS Source: own elaboration

The purpose of the game is for the student to learn the important stages of statistical analysis performed to compare two research groups (Figure 7). Scenario: segregate the terms into two categories (Hasła dla PORÓWNANIA, INNE Hasła). The student's activity consists in interacting with the application: the student shifts the rectangle with a term onto the graphics of the container the student has selected. The entire interaction of the student in the application is subject to time monitoring (the rectangles are animated – they fall down). A correct sorting decision causes the term to disappear from the line of terms falling down. The game is supplemented with an example of a research problem that describes the methods and ways to conduct the analysis.

#### Tile Game

The objective of the game is to review the topics pertaining to the measurement scale used in statistical analyses (Figure 8). Scenario: segregate the terms into two groups: terms connected with the subject being studied (skala porzadkowa) and terms not connected with it. The terms must be put into two heaps at the bottom of the window. The pace at which the answers are given is calculated as time of operation of the game's interface. The student chooses the side of the card that he or she considers to be correct with a pointer device, and the application starts an animation showing cards being put on the correct shelf. The game is supplemented with the definition and examples of medical problems on different measurement scales.



Figure 8. Tile game in LCDS Source: own elaboration

#### 4.3 Action Maze in e-learning materials

Engineering and technical education (Figure 9). We assume that the student has become familiar with the design and the principles of operation of a combustion engine (SILNIK SPALINOWY). A decision labyrinth is prepared that requires the student to diagnose a failure of an engine (Diagnostyka). The possible scenarios of the first stage of diagnosis are described (Usterka 1). Each scenario (e.g. Niedokręcony element nr 1) is a new situation, always dependent on the decision made earlier (if component A is removed from the engine, a new situation is visible, which then leads to new questions). It is the easiest to draw the process and then to edit the problems and the possible decision scenarios in the e-learning materials editor (using an appropriate template). The decision labyrinth in this specific application is the Adventure Activity template from the Interact group. The authors see broad applications for this edition template, or, more broadly, this type of interactions in e-learning materials in such fields as medicine, information technology, engineering, etc.



#### Figure 9. Action Maze in LCDS

#### Source: own elaboration

Of course, at the end of each path taken by the user, information should be provided on the evaluation of the correctness of the decisions made by the user.

#### 4.4 Interfaces of self-tests

In teaching statistics to students of medicine or computer science, the authors have used various self-test interfaces in the QTI 1.2 standard (http://www.e-mentor.edu.pl/artykul/index/numer/49/id/1005). What distinguishes the QTI 2.1 standard is the ability to better adjust to the unique characteristics of the tested knowledge. The choice of an appropriate interaction should be dictated by the objectives of the learning process and one must keep in mind that an excess of stimuli can lead to loss of focus. Figures 10,11 and 12 show examples of an interface

for single- and multiple choice questions in the QTI 2.1 standard. Other examples can be found at the website https://webapps.ph.ed.ac.uk/qtiworks/anonymous /samples.

Inline text selection	Not Answered
This is a typical MathAssess item. It has rich feedback, so this de item as many times as you like. There is no template processing example.	emo lets you try the (randomisation) in this
In-line selection.	
An option may have unique feedback when selected or not select Each option may have its own mark value, and these can be neg Options can be put in random order (the third and fourth lists are	ted. ative (not used here). randomised here).
Identify the missing words in this famous quote from Shakespear	e's Richard III.
Now is the (Select) v of our discontent	
Made glorious (Select) $\checkmark$ by this sun of (Select) $\checkmark$ ;	
And all the (Select) that lour d upon our nouse	
sorrows line ocean buried.	
SUBMIT RESPON weeds	
Reset Finish and review Exit	

## Figure 10. Single choice in QTI 2.1.

Source: https://webapps.ph.ed.ac.uk/qtiworks/anonymous/samples

UK Airports (Take 1) Finished
This is a typical standard IMS sample question. It has a model solution, but no feedback. In this example, we'll let you give you one attempt at the question before it closes. You can still reset the question and try it again, though.
The picture illustrates four of the most popular destinations for air travellers arriving in the United Kingdom: London, Manchester, Edinburgh and Glasgow.
Which one is Glasgow?
Open Author's Feedback         Reset and play again         Show model solution         Exit

Figure 11. Single choice in QTI 2.1, different interface.

Source: https://webapps.ph.ed.ac.uk/qtiworks/anonymous/samples

Pairing style Not Answered
This is a typical MathAssess item. It has rich feedback, so this demo lets you try the item as many times as you like. There is no template processing (randomisation) in this example.
Pairing.
Select matches for items in a list. The number of matches does not have to match the number of items. Matches can be used more than once or not at all. Both lists can be randomised (and are here), but any one item can be fixed in a given position if required. The number of matches can be given a fixed limit.
Select the appropriate number for each text value, where you can :
31 12 14 8 24 5
twenty four
SUBMIT RESPONSE
Open Author's Feedback Reset Finish and review Exit

Figure 12. Multiple choice in QTI 2.1.

Source: https://webapps.ph.ed.ac.uk/qtiworks/anonymous/samples

#### CONCLUSION

Interactive materials are very important in distance learning. The use of electronic tests, quizzes, or games and gaining experience in simulated conditions are also recommended (Szandurski 2012) for improving and developing individual key competences defined by the European Parliament.

When working on editor tools, programmers can use a number of dynamically developing technologies. There is a lot of interest among users in enriching the interface by using new interactive elements. In the opinion of the authors, there are a number of innovative ideas that are worth implementing in the educational materials created by teachers.

#### REFERENCES

- Jędryczkowski, J., 2013: *Motivation in the e-learning process*. General and Professional Education, No. 1/2013, pp.16. ISSN: 2084-1469
- Kowalewski, W., Kołodziejczak, B., Roszak, M., Ren-Kurc, A., 2013: *Gesture recognition technology in education*. Proceedings of Distance Learning, Simulation and Communication 2013 (Selected papers), May 21-23, Brno, Czech Republic, Hrubý, M. (Ed.), pp.113-120. ISBN: 978-80-7231-919-0. Available at http://dlsc.unob.cz/data/Proceedings%20of%20the%20DLSC% 202013%20conference.pdf, (accessed on 1August 2013)
- Margulis, L., 2005: The Playful Aspect of e-Learning Play in Virtual Learning Environments. E-mentor No. 1 (8), 2005, pp.83-86. ISSN-1731-6758. [In Polish]
- Page, B., Kreutzer, W., 2006: A Framework for Web-based E-Learning of Discrete Event Simulation Concepts. 17th Simulation and Visualization 2006, Mar 2-3, Magdeburg, Germany, pp.195-204, available at http://ir.canterbury. ac.nz/handle/10092/441, (accessed on 1August 2013)
- Ren-Kurc, A., Kowalewski, W., Roszak, M., Kołodziejczak, B., 2012: Building Digital Content for E-Learning. Information and Communication Technologies (ICT) Competence. E-Learning for Societal Needs, Smyrnova-Trybulska, E. (Ed.), Studio Noa, Katowice-Cieszyn, 2012, pp.201-212. ISBN: 978-83-60071-59-5
- Roszak, M., Kołodziejczak, B., Kowalewski, W., Ren-Kurc, A., 2013: Standard Question and Test Interoperability (QTI) – the evaluation of student's knowledge. E-mentor, No. 2 (49), 2013, pp. 35-40. ISSN: 1731-6758. [In Polish]
- Roszak, M., Kołodziejczak, B., Ren-Kurc, A., Kowalewski, W., Bręborowicz, A., 2013: Repetitions and summaries in distance learning materials. Learning Content Development System (LCDS). E-mentor, No. 1 (48), 2013, pp.40-46. ISSN-1731-6758. Available at http://www.ementor.edu.pl/artykul/index/numer/48/id/989, (accessed on 1 August 2013). [In Polish]
- Szandurski, J., 2012: Possibilities and limitations of e-education in the improvement of key competencies. E-learning – tools and practice, Foundation for the Promotion and Accreditation of Economic Education, Dąbrowski, M., and Zając, M. (Ed.), 2012, pp.103-112. ISBN: 978-83-63127-06-0. [In Polish]
- Official Journal of the European Union (2006). Key Competences for Lifelong Learning - A European Reference Framework. 30.12.2006, L394/13-16. Available at http://eurlex.europa.eu/LexUriServ/LexUriServ.do? uri=OJ:L:2006: 394:0010:0018:en:PDF, (accessed on 1 August 2013)
- The IMS Global Learning Consortium, Available at http://www.imsglobal.org/, (accessed on 1 August 2013)
- Patient Simulation, University of Washington School of Medicine, Available at https://www.mebi.washington.edu/patientsimulation/ tutorial\_print.html, (accessed on 1 August 2013)

## VIRTUAL CHEMICAL LABORATORY VIA DISTANCE LEARNING

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Abstract: The problems of representation and learning material in distance learning are successfully solved, but development of professional skills is a problem, that requires a solution, especially for teaching natural sciences such as Chemistry. The article deals with issues related to the organization and implementation of laboratory chemical experiments via distance learning. This paper covers a classification of virtual chemical laboratory. The author proposes to use free ware program Virtual Chemistry Laboratory teaching Chemistry. Distance learning has the advantages that this program can be installed on a local computer and on-line. Moreover the local version and on-line version of this software can be presented in different languages. The paper gives examples of laboratory work. The author studies the creation of new laboratory work in chemistry using this program.

Keywords: distance learning, virtual chemistry laboratory

#### **INTRODUCTION**

Distance learning has already become reality in education, so the questions of determination of the definite problems for its organization have been appearing. The problems of presentation and getting the educational material for distance learning are solved successfully. However there is a problem of forming the practical skills and abilities. This problem needs solving especially to teach natural sciences including chemistry. According to (Jarkykh, Lysochenko, Sus, Tretyak, Shkavro, 2010) the student gains knowledge and acquires skills doing the experiments. And this is an essential condition of forming the specialist's professional competences.

The virtual chemical laboratories are recommended to be used for organization and implementation of experiments for distance learning. This is emphasized in (Morozov, Tanakov, Gerasymov, Bystrov, Tsvyrko, Dorofeev, 2004), (Truhyn, 2005), (Grygorieva, Grygoriev, 2010).

## **1. VIRTUAL CHEMICAL LABORATORYS**

*Virtual chemical laboratory* are complex of the programs which are necessary to imitate the implementation of experiments in a chemical laboratory.

Nowadays there are a lot of virtual chemical laboratories. They can be divided into three groups. It is depended on the commands a user chooses (Truhyn 2002):

- Programs for visualization of experiments establishing some parameters of its course. For example, VirtuLab is one of such programs, developed by Virtual laboratory "VirtuLab", at www.virtulab.net. Some parameters of the experiment can be changed using this program, so and a user course watches the differences in course.
- Simulation programs for experiments of separate class. For example, Interactive Simulations is one of such programs developed by University of Colorado, sitehttp://phet.colorado.edu. This program consists of modules that help simulate separate experiments. Different parameters can be set to do them as well as different tools can be chosen.
- Chemical laboratory simulation programs are complicated simulation systems. There is a powerful mathematical apparatus in their base. A user can add the models and set their parameters to do new experiments. And this is a key difference of these programs. The programs of this group can be divided into two sub-groups: simulation programs for various natural effects and simulation programs of the type of effects. For example, commercial program Yenka developed by Crocodile Clips Ltd, site http://www.yenka.com appertains to the first sub-group. Free ware Virtual Chemistry Laboratory is one of those appertain to the second sub-group.

## 2. VIRTUAL CHEMICAL LABORATORY

*Virtual Chemistry Laboratory* can be described as a program that has got some advantages of using it in distance learning:

- that program can be installed on a local computer (there are versions for operating systems *Windows* and *Macintosh*) and on-line, site *http://chemcollective.org/vlab/vlab.php*;
- the versions of that program are presented in multiple languages: English, Spanish, Catalan, French, Portuguese, Greek, German, Russian, Hebrew, Galiysca, Arabic, Lithuanian, Chinese.

*Virtual Chemistry Laboratory* is a visual simulator of a laboratory and inorganic and analytical chemistry laboratory work. It also includes the editor of new laboratory work. *Virtual Chemistry Laboratory* has been developed and supported by *University Carnegi Mellona* within *IrYdium* project.

Java! must be installed for Virtual Chemistry Laboratory program running.

Java! is loaded from the web-page of http://www.java.com/en/download /manual.jsp. The hyperlinks Downloads and Try the offline installer must be chosen to save the distribution file Java! on a local computer. This archive the distribution can be used to install Java! on other computers.

Web-page *http://chemcollective.org/applets/vlab.php* is necessary to load the distribution of *Virtual Chemistry Laboratory* for installation on a local computer using hyperlink [51MB] Virtual Lab International Version 1.6.4 with Java. After that, it is necessary unpack the loaded archive and run the appropriate file to use version of the program in a proper language. The name of each file consists of 6 symbols: *VLab* and the last two marks are symbols of the language of version of the program is given in Figure 1.



Figure 1. The window of program Virtual Chemistry Laboratory

Source: The ChemCollective, site http://chemcollective.org/

The experiments including the standard set of reagents can be simulated with the help of that program. A new set of reagents can be created using the module *VLabAuth* downloaded from the web-page *http://chemcollective.org/authoring.php* and hyperlink *Virtual Lab Authoring Tool [1MB]*.

## 2.1. Simulation of experiments

The command *File / Load Homework* must be chosen to load prepared tasks. The tasks must be chosen from the list in the window of *Load Homework* (Figure 2). All the developed tasks are presented in English.



Figure 2. The window Load Homework

Source: The ChemCollective, site http://chemcollective.org/

For example: it is necessary to determine the concentration of solution of sodium hydroxide (NaOH) using a 0.500 M potassium hydrogen phthalate (KHP) with help of titration.

#### Accomplishment:

- a) "take" from *Stockroom Explorer*... of reagents NaOH, KHP, phenolphthalein and "put" them into the *Workbench:* a suitable reagent must be chosen clicking twice the left key of a mouse or "pressing" the button *Click to retrieve a solution from the stockroom* or "moving" the suitable reagent;
- b) a burette and a disposable pipette must be chosen from the list *Click to select new glassware from the drop-down menu* (Figure 3);



Figure 3. The window to simulate the experiments

Source: The ChemCollective, site http://chemcollective.org/

c) "take" a little phenolphthalein (~ 0,3 ml) using a disposable pipette: the image of the disposable pipette must be moved on the image of phenolphthalein, enter a proper volume of phenolphthalein in the field *Transfer amount (ml)*:and "press" the button *Withdraw* (Figure 4);



## **Figure 4. "Collecting" with a pipette phenolphthalein** Source: The ChemCollective, site http://chemcollective.org/

d) "fill" a burette with solution NaOH: according to the previous point;



## Figure 5. The result of exercise

Source: The ChemCollective, site http://chemcollective.org/

e) make "titration" NaOH from a burette to KHP, until a little change of colour. "Titration" is carried out according to the point c). That can be also made with help of precise mode of "addition" of the reagent: choose the

command *Transfer Bar /Precise transfer* in the menu *Tools*, introduce 13.23 to the field *Transfer amount (ml):*, "click" the button *Withdraw*. The concentration NaOH is 0,9445 M and there is some light pink liquid in the retort (Figure 5).

#### 2.2. Create a new task

A teacher can create new tasks in two ways:

- a proper file with extension of *.xml* must be chosen from the list with help of the command *File / Open* on the basis of the already existent task (edit);
- the creation of a new task with help of the command *File / New*.

After choosing the command *File / New* a new window will be opened to enter parameters of a new task (Figure 6).

	d General
General	These properties affect how the problem appears in the Load Homework Dialog.
Permissions	Title:
Species	Author:
Reactions	
Stockroom	

Figure 6. The window for entering task parameters

Source: The ChemCollective, site http://chemcollective.org/

It is necessary to set all the parameters of the new task for each and all points: *General, Permission, Species, Reaction, Stockroom.* 

General:

*Title* is the name of a task.

Author is the author of the created task.

Short Description - a short description of the task: the description of a task and supplementary information which is necessary to do this task.

It is reasonable to create a folder to save the task in the file with expansion .xml with help of the command *File / Save as*. Files are saved in the folder *My documents* by default.



## Figure 7. The window to select items displayed in the task

Source: The ChemCollective, site http://chemcollective.org/

Example	-* Ø X		
General	Permissions Permissions can be set on each of viewers and transfer bars that appear within the lab.		
Permissions	Viewers Transfer Bars		
Species	The following transfer bars are enabled:		
Reactions	<ul> <li>Significant Figures Transfer</li> <li>Realistic Transfer</li> </ul>		
Stockroom	Add / Modify 🗊 Delete		
Stockroom	Add Modify 🗊 Delete		

**Figure 8. The window to select the display mode "transfer" of the substances** Source: The ChemCollective, site http://chemcollective.org/

*Permission* (Figure 7 and 8) is the mode of display of the proper elements of the window *Virtual Chemistry Laboratory*. The elements can be visible or invisible working with the task.

	Species			
General	Each species	has specific chemic t reacts in solution.	al properties t	hat
Permissions	Name	Enthalpy	Entropy	State
	COH <sub>2</sub> O	-285.83	69.91	1
	CO H+	0.0	0.0	aq
species	CO OH-	-229.99	-10.75	aq
Reactions				
Stockroom				
	5 Add	/ Modify	1 Delet	141 C

Species (Figure 9) – properties of the component reagents can be added or edited.

## Figure 9. The window for editing the properties of reactants

Source: The ChemCollective, site http://chemcollective.org/

The properties of components in the reaction are described creating a new task.

Addition of component reagents: the command File / Open is used to add the component reagents from another task to this one.

The information about the proper component reagents from another task to this one can be copied with help of the commands *Edit / Copy* and *Edit / Paste* after opening this task in the window of the point *Species* (Figure 9).

It is necessary to press the button *Add* (Figure 9) and open the window to enter parameters of the component reagents (Figure 10):

Species is an image of chemistry symbol or formula of component reagents. The standard formatting HTML is used to add an upper index or a low one.  $\langle SUB \rangle \langle SUB \rangle$  is suitable for the low index,  $\langle SUP \rangle \langle SUP \rangle$  is suitable for the upper index. For example, "2" in H<sub>2</sub>O is $\langle SUB \rangle 2 \langle SUB \rangle$ , + in H<sup>+</sup>is $\langle SUP \rangle + \langle SUP \rangle$ .

State is the state of a reagent (water (aq), liquid (l), solid (s), gaseous (g)).

*Enthalpy* (*kJ/mol*) is enthalpy (use the proper reference books to enter for introduction of correct value).

*Entropy* (kJ\*mol) is entropy (use the proper reference books to enter for introduction of correct value).

Molecular Weight is molecular weight.

Color is colour of a reagent.

*Color Concentration* is the coefficient of colour changing of changing the concentration of solution.

📋 (new) [Examp	le] d* 🗹 🔀
C Species:	(new)
State:	aq 💌
Enthalpy (kJ/mol):	0.0
Entropy (JK*mol):	0.0
Molecular Weight:	0.0
Color:	
Color Concentration:	0.0
\$	Previous Next 📎 🕅 💥 Close

#### Figure 10. The window for entering the parameters of component reagents

Source: The ChemCollective, site http://chemcollective.org/

The button *Previous* is used to pass to the description of the previous component of the reaction. The button *Next* is used to describe the next component there action. The button *Close* (Figure 10) is used to close the window to enter the parameters of the substance.



**Figure 11. The window for editing of the reaction equation** Source: The ChemCollective, site http://chemcollective.org/

The button *Modify* is used to call the window for editing of properties of the already determinate substance (Figure 9).

The point *Reaction* (Figure 11) is used to edit the equation of the reactions in the task. All the possible reactions between the reagents must be described accurately.

The button *Add* (Figure 11) is used to open the window for adding a new reaction (Figure 12).

🦳 <==> [I	xample]	4 Q X
Reaction terr	n: <==>	
Product	Coef.	Species
	1.0	Add term
		00 H <sub>2</sub> 0 00 H+ 00 OH
	Pre	vious Next 📎 🕅 💥 Close

#### Figure 12. The window for adding the description of a new reaction

Source: The ChemCollective, site http://chemcollective.org/

At first the reagents must be chosen from the list in the column *Species* and after that the result of the reaction must be marked in the column *Product*. The coefficients must be determined for equalization of the reaction in the column *Coef*. (Figure 12).



# Figure 13. The window for selection display of the materials in the *Stockroom* laboratory

Source: The ChemCollective, site http://chemcollective.org/

The properties of all the components of the reaction are copied while the reaction of a task is copied from another task.

The point *Stockroom* (Figure 13) is creation and edition of the display of substances in the laboratory stockroom (the creation of realistic images).

The *Cabinet*, the *Solution*, the *Problem Description* for a task can be added with help of the button *Add* (Figure 14).



## Figure 14. The menu for adding laboratory items

Source: The ChemCollective, site http://chemcollective.org/

Distilled	H2O [Example] 🛛 🗗 🖾		
Solution	Distilled H <sub>2</sub> 0		
Description:	Distilled Water		
Volume (mL):	3000.0		
Vessel:	sel: 🔲 3L Carboy 🔷 🗸		
Contents:			
Moles	Species		
0.0	Add species		
	Previous Next > Close		

## Figure 15. The window for setting the parameters describing of the solution

Source: The ChemCollective, site http://chemcollective.org/

The parameters of an element are set in the open window in Figure 15 and 16.

Parameters of description of the solution (Figure 15):

Solution is the name of solution.

Description is a label of the solution on a vessel.

*Volume (ml)* is volume of solution.

*Vessel* is a vessel for solution.

Contents are components of solution.

Moles are quantity of components of the solution in moles.

Species are a denotation of components of the solution.

Problem	n Description [Example] 🖉 🗵
Name:	Problem Description
Description:	Problem Description
C Edit	Q Preview
<html></html>	
<title>I </title>	Problem Description
	xidth="100%" border="0" cellpadding="3"cellspace
<td< th=""><td>bgcolor="#9F9FCF" align="left"&gt;</td></td<>	bgcolor="#9F9FCF" align="left">
<1	iont face="Arial, Helvetica, Sans-serif">
	<strong>Problem Description</strong> /font>//
	Previous Next > Close

# Figure 16. The window settings the parameters describing the annotations of a task

Source: The ChemCollective, site http://chemcollective.org/

## Parameters of describing the annotation for a task (Figure 16):

Name is the name of annotation.

Description is the label of the annotation.

Edit is necessary to edit contents of the annotation as codes HTML.

Preview is previous revision of the contents of the annotation.

The command File / Preview is used to preview the created task.

Addition of the created task to the Virtual Chemistry Laboratory:

- 1. Copy the file with the saved parameters of a new task to the folder *assignments*.
- 2. Add such a fragment:

<PROBLEM url="assignments/<the file name>.xml">

<TITLE>Назва завдання</TITLE>

<AUTHOR>Прізвище автора</AUTHOR>

<DESCRIPTION>

#### thumb-nail sketch of task

</DESCRIPTION>

</PROBLEM>

A user enters just the name in bold of the file that contains the information about a new task. The short description in bold of the task can be entered if it is necessary. The command *File / Load Homework* in the program *VLab* is used to load this task.

## CONCLUSION

Using of this program for organization and implementation of distance learning is necessary:

- to do chemistry experiments in distance;
- to use own tasks by the teachers the depending on the goals of learning;
- to use the version of the program on-line to expend the range of computers used for distance learning;
- to increase circle of students that can study in distance to using different language versions of the program.

## REFERENCES

- Grygorieva, L.,S., Grygoriev, V.,A., 2010: Using virtual chemistry laboratory via distance learning. Letters in Emyssia. Off line, available at http://emissia.org/offline/2010/1472.htm (accessed on 1 July 2013).
- Jarkykh, U.,S., Lysochenko, S.,V., Sus, B.,B., Tretyak, O.,V., Shkavro, A.,G., 2010: Laboratory practical work as a problem of distance learning. The set of scientific works of Kamyanez-Podylsk National Ivan Ogyenko University. Educational series: Forming of experimental modes of activity according to modern vocationally significant qualities of a specialist, 2010, Is. 16, pp. 150 – 152.
- Morozov, M.,N., Tanakov, A.,I., Gerasymov, A.,V., Bystrov, D.,A., Tsvyrko, V.,E., Dorofeev, M.,V., 2004: Exploitation of virtual chemistry laboratory for school education. Educational Technology & Society. 2004. V. 7. No 3. pp. 155–164.
- The ChemCollective. Virtual Lab Simulator, available at http://www.chemcollective.org/vlab/vlab.php (accessed on 1 July 2013).
- Truhyn, A., V., 2002: About using virtual laboratories in education. Open and distance learning. Tomsk, 2002. No 4 (8). pp. 67.
- Truhyn, A., V., 2005: The types of virtual computer laboratories informative technologies in high education. Almaty, 2005. V. 2, No 2. pp. 58-68.

## E-ACADEMY OF THE FUTURE- 3 YEARS LATER. PRELIMINARY EVALUATION OF THE PROJECT

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**Abstract:** This paper aims at showing the preliminary evaluation of E-Academy of the Future, a program aimed at Polish middle-school learners, from the perspective of the authors of the English e-learning units. It addresses the issues of the pedagogical model used, the adequacy of the project materials, the process of their implementation and the effectiveness of cooperation with schools. Finally, the paper gives recommendations for the future and suggestions for changes on the level of e-project design and implementation, including teacher training.

Keywords: Key Competencies for Lifelong Learning, e-learning units, middle school learners, evaluation

For me key competencies are the basics; yet, they are too often exaggerated mainly by the teachers- a middle school user of the e-Academy of the Future project<sup>1</sup>

## **INTRODUCTION**

The 1st of September 2010 marks the day when 22,376 pupils from 200 middle schools in Poland started their work in the E-Academy of the Future project, one of the most comprehensive and innovative programs of this kind in Poland if not in Europe. More than 2,000 teachers learned about the Project several months earlier when the principals told them that their schools had joined the program. A group of authors, though, had been working on the Project since October 2009. The team consisted of authors, experienced teachers and educators, all supervised by the

<sup>&</sup>lt;sup>1</sup> All learners' quotes come from M. Kalinowska's presentation delivered during the June 2013 GPKK Authors' Conference (GPKK – *Middle School Program for the Development of Key Competences* [in Polish])

Project directors from WSiP. Some of them had done e-learning projects before; for some of them it was a new experience.

The authors' task was to create 168 English e-learning units (each meant for a 45minute self-study practice) that were to shape the seven key competences as defined by the *Recommendation of the European Parliament and of the Council on Key Competences for Lifelong Learning.* All 168 e-learning units were to be implemented in the coming three years for the use of middle school learners and teachers in Poland.

The distribution was as follows:

- 21 e-learning units for biology, chemistry, physics, geography, English language
- 12 units for IT and WOS (Knowledge about the Society)
- 33 units for mathematics
- 6 units for learning to learn competence

The e-learning units were just a part of this very comprehensive interdisciplinary program, co-financed by the EU as a part of the European Social Fund, which used blended learning, project work methods, virtual academic circles, compensatory groups, diagnostic testing. For this purpose, there was launched an e-learning platform, hosting all project-related materials (Okońska-Walkowicz 2009). Moreover, schools received interactive whiteboards and teachers got netbooks in order to implement all materials.

This paper, written a few months after the project ended, presents the findings and thoughts resulting from the Project's evaluation, prepared by the Project evaluators Trexis-Press, under the supervision of Maria Kalinowska, the Project's Director (Ewa Grela), its Coordinator (Elżbieta Faron-Lewandowska) and the English units authors' (Gadomska, Krajka) reflection and recommendations for the future.

## 1. THEORISING THE LEARNING APPROACH - CONTENT VS. TECHNOLOGY IN THE COMPUTER-ASSISTED LANGUAGE CURRICULUM

Before presenting the picture of the Polish education influenced by the information society of the beginning of the 21<sup>st</sup> century, it is worthwhile reflecting upon the role of technology in the foreign language curriculum. While the use of computers as a mere novelty to create the "wow factor" should no longer be the main focus of educators, the meaningful implementation of cutting-edge technologies such as Interactive Whiteboards with tablets or voting systems should not be disregarded altogether.

What is important, on the other hand, is educators' awareness of distinct models of technology use, reflecting the interrelationship between subject matter content, foreign language skills development and technology. At this point we will quote the framework of ICT use for teacher training, presented by Collis and Jung (2003) and expanded by Jung (2005), adapting it to the language learning reality.

As Jung (2005) highlights it, learners can be "trained to learn HOW to use ICT" or learners "can be trained VIA ICT" (p. 95), with the computer-assisted component used either as a core or a complementary means to the teacher training process. This crucial distinction needs to be already addressed in the lesson planning process – whether the starting point for the teaching scenario is the pedagogical purpose which finds its suitable technology, or, on the other hand, a particular website's or technology's affordance is exploited with some benefits for the language learning process.

The particular approaches presented in Jung's model are briefly described below, followed by a reflection on how the framework of E-Academy of the Future actually fits in it.

#### A. ICT use as part of teaching methods

This approach integrates ICT into the language learning process to facilitate some aspects of instruction. Integration in the classroom is achieved by demonstrating examples and allowing discussions among learners throughout the whole training process. Learners are asked to actually use ICT to learn about ICT skills and develop their own ICT-integrated learning habits and strategies. This particular approach is supported by some previous research that argues that learners are likely to benefit more from the instruction by actively experiencing ICT skills.

#### B. ICT as core technology for delivering learning

In this approach, ICT is used as the major way of providing the learning experience. The content of this approach does not necessarily focus on an ICT skill itself but rather covers a variety of technology applications, and it is either the content transferred through technology or the language learning experience triggered by technology that are central to the process. While technology is essential to successful accomplishment of the learning sequence, it is subordinated to content in the sense that it does not impose the way in which content would need to be transformed.

#### C. ICT used to facilitate networking

Whereas the use of ICT as core technology for delivering language instruction can be found in limited contexts, there are many examples of ICT, particularly the Internet and Web-based communication technologies, being used to support learners' ongoing linguistic development and networking. Online resources for language learners facilitate their networking based on the assumption that foreign language use should be an integral part of daily practice for all language learners and the use of the Internet would enhance their continuous professional development activities, connecting them to larger communities and allowing for interaction with expert groups (Jung 2005).

Interestingly enough, we feel the impact of E-Academy of the Future has been significant due to the fact that the project does not give priority to any of the abovementioned content-language-technology setups as specified by Collis and Jung (2003) and Jung (2005). On the other hand, all the components of the model are duly acknowledged and activated to lead towards balanced development of foreign language competence. The very approach adopted in E-Academy of the Future is, thus, multi-layered, with different models of ICT use available for use as separate layers.

To start the analysis, the very e-learning units do use ICT as a main content focus, especially those units devoted to the development of the digital competence, with such skills tapped into as selecting and verifying reliability of online resources or preventing and struggling with cybercrimes. What is important, however, is that those selected aspects of the digital competence are developed through evoking particular contexts, building narratives and bringing pieces of knowledge together. This first layer, which uses ICT as a main content focus, is relatively low-tech – apart from animations, close-ended language exercises or audio manipulation options the materials do not make sophisticated uses of technology themselves. This is the first major asset of the project – increasing impact through controlling accessibility measures, so that ICT as core delivery technology is kept to a minimum in order not to put learners from under-resourced settings at a disadvantage.

The second layer in the project is what the teacher can actually do with the readymade materials in the classroom. While the e-learning units are not editable in themselves, they can be used in multiple modes in the classroom with the IWB tools to focus learners' attention and maximise acquisition of language input. Given flexible options of screen annotation tools (see Gadomska and Krajka 2011; Gadomska, Morusiewicz and Krajka 2012), the extent of this manipulation is extensive, and it depends on teacher's skill, learners' needs and logistical considerations. Regrettably, the use of E-Academy of the Future in the classroom, with the materials enhanced by a skilful use of the Interactive Whiteboard, was not as wide as was expected.

Finally, the third layer of use, in which content, language use and technology are interrelated, is the use of the e-learning platform to communicate with other project members, collaborate in common projects and create communities of interest. Jung's (2005) component of ICT as a facilitating or networking technology is exploited in this respect. While there was interaction among project members on the platform, it seems that once e-learning units become freely available to all students, not only from Poland, the virtual collaborative space will gain its proper scale. The teaching model of E-Academy of the Future, thus, is presented in Figure 2, where the concentric circle shape indicates this multi-layered structure.



Figure 1. Revised Model of ICT-Content Interrelationship Implemented in E-Academy of the Future

Source: authors' original idea

## 2. PRELIMINARY EVALUATION OF THE E-LEARNING UNITS

For me [key competencies] are the knowledge covered by the e-learning units. The transfer the knowledge in an easy and a pleasant way. Sometimes they are too long and the avatars appearing in the short films talk too slow- a middle school user of the e-Academy of the Future project.

## 2.1. Method and Procedure

Trexeris-Press evaluated the Project ex-post by means of a quantity research method, supported by the Computer-Assisted Web Interviewing (Kalinowska 2013). They interviewed 160 school headmasters, 1,017 teachers and 13,500 pupils. The findings refer to a variety of aspects, materials and activities of the e- Academy of the Future project. However, the authors would like to focus on these results that concern only the e-learning units.

## 2.2. Results and Findings – Overall Evaluation

85.3% of teachers claim that the e-learning units were most useful (among all project related materials) in shaping key competencies (Table 1).

#### Table 1.

According	to reachers.
Educational materials	Teachers
Knowledge base	47.3%
E-learning units	85.3%
Out-of-class materials for special educational needs pupils	21.2%
Out-of-class materials for skilled pupils	24.0%
Handbooks	15%
Diagnostic tests	44%

#### Usefulness of Project's Materials in Shaping Key Competencies – According to Teachers.

Source: Kalinowska 2013

Moreover, 43.3% of pupils found e-learning units most useful in the learning process (Table 2).

One out of four respondents found e-learning units as very good and 45.2 % of teachers as good. Moreover, although they were most consistent with the expectations and most recognizable project materials, diagnostic tests turned out to be equally important and valuable for pupils (Kalinowska 2013). In addition, the evaluation proved that the project contributed to the process of shaping key competencies, but mainly the following ones: learning to learn competence, digital competence, mathematical and basic competences in science and technology. From the pupils' perspective, digital competencies are mainly shaped outside the classroom. The Project's e-learning platform and its tools lost to popular social forums, communicators (Kalinowska 2013).

Table 2.

Usefulness of Project's Materials in the Learning Process – According to Pupils

Educational materials	Pupils
E-learning units	43.3%
Outside classroom materials for skilled pupils	11.3%
Diagnostic tests	42.0%

Source: Kalinowska 2013

During the June 2013 GPKK Authors Conference, the Project's Coordinator (on behalf of WSiP) Elżbieta Faron-Lewandowska presented the results of the survey on

the e-learning units conducted among the teachers during summer training sessions (organised after the first, second and third year of project) (see Table 3).

#### Table 3.

Content-related and didactic merits	Content-related and didactic drawbacks
<ul> <li>attractive, dynamic, innovative, learner-friendly, cross-curricular</li> </ul>	<ul> <li>difficulties with logging to the platform, access to computers and the Internet</li> </ul>
<ul> <li>building learner's autonomy, self- study, time-management skills</li> <li>helping to individualize the learning process</li> </ul>	<ul> <li>" a pupil is more IT advanced, which causes discomfort of teachers"</li> <li>" the learning process depends on the</li> </ul>
<ul> <li>developing pupils' interests</li> <li>providing control tools for teachers and review/ repetition options</li> </ul>	<ul> <li>web options"</li> <li>"problems with deadlines for e- learning units, computer lab sharing"</li> </ul>
<ul> <li>transferring knowledge into practice</li> <li>shaping key competences</li> </ul>	<ul><li>- "stress because of extra work"</li><li>- "extra burden for pupils"</li></ul>
<ul> <li>" building IT competence so important in the future career"</li> </ul>	<ul> <li>"too long/ difficult/time- consuming units"</li> </ul>
<ul> <li>"boosting the feeling of being up-to- date with modern technologies"</li> <li>"prestigious for the school"</li> </ul>	<ul> <li>"imposing the e-learning method"</li> <li>"automatic way of doing the activities"</li> </ul>
<ul> <li>"boosting teachers' skills"</li> <li>"material suits the interests of parents"</li> </ul>	<ul> <li>"no division into levels of difficulty of the e-learning materials- problems with choosing adequate materials"</li> <li>"pupils cheating"</li> </ul>
<ul> <li>- "in accordance with the current strategies for education development"</li> </ul>	<ul> <li>"no correspondence between the e- learning materials and the classroom course book"</li> </ul>

## Teachers' Opinions on the E-learning Units in the E-Academy of the Future Project

Source: Faron-Lewandowska, 2013

## 2.3. Results and Findings - Methodology

As regards the evaluation of the Project's methodology, teachers reported using:

- mostly fragments, particular exercises, activities, experiments by teachers during lessons
- the section of Knowledge/Lesson during a classroom lesson and assigning the sections of Practice and Test as homework
- the section of Knowledge during a lesson, assigning Practice as homework and the corresponding Test part in the paper based version in the class

- the section of Knowledge as self-study material before the lesson, while implementing Practice and Test in class with the teacher's supervision
- all three sections (Knowledge, Practice and Test) as self-study material with set deadlines
- the e-learning units as revision material before a classroom based test.



## Figure 2. Average Number of Teacher Entries in the School Year – from September (09) to June (06)

Source: Faron-Lewandowska 2013



Figure 3. Average Number of Pupil Entries in the School Year

#### - from September (09) to June (06)

Source: Faron-Lewandowska 2013

It can be concluded that teachers mainly used the Lesson/Knowledge section of the e-learning unit through the school year (Fig. 3), which was substantially ineffective

as from the authors' perspective the two sections of the unit (Knowledge and Practice) were integral. It can be also seen (Fig. 4) that pupils mostly used the testing section, which may mean that they were obliged to take the test and were rather reluctant to consult Practice and Knowledge. It may be suggested at this point that perhaps the names of sections assigned at the beginning of the project were misleading for both authors and teachers and should have been changed into Knowledge and Practice 1 and 2 plus Test. In effect, at least teachers could have been encouraged to use the Practice section more. In case of the English units this decision could have been especially beneficial as our Practice section was a continuation and development of the language material introduced in the Knowledge of the unit and not of a "practice" character exclusively. However, it can be also concluded from the graphs above that the motivation of pupils to use the two first sections of the unit was rather low and unsatisfactory.

Figure 5, however, illustrates the usual day time when the users were working on the platform. They used the platform mainly after the lessons as usually the lessons in a Polish middle school end about 2 p.m. in the afternoon. The biggest number of hits was observed in the late afternoon or even in the evening, which proves that the units (and here again mostly the tests) were used as self-study/ homework material for pupils and reference material for teachers. The question arises here to what extent it is effective to take the test without sufficient usage of the corresponding knowledge and practice.



## Figure 4. Daily Distribution of Hits - All Users

Source: Faron-Lewandowska 2013

It has to be noted, however, that the above presented data on the distribution of entries into all parts of the e-learning units by teachers and pupils (Fig. 5-7) refers to all units in the Project and not to the English units exclusively.

According to Ewa Grela, the Project's Director, pupils spent on the platform approximately 8.4 hours during classroom activities and 8.2 hours during self-study

time per month (Grela 2013). That is not much comparing to the time spent by the same pupils using social networks, communicators or just surfing the net. "*The Youth of 2011* report, prepared by the team of experts under the supervision of the Polish minister Michał Boni, shows that the young Poles spend from 17 to 20 hours weekly online" (Szafraniec qtd in Gadomska, Krajka 2012: 105)

## **3. FINAL CONCLUSIONS**

For me key competencies are the following: family, love, friendship, work, social life, sex, a car, a bike and sport- a middle school user of the e-Academy of the Future project

The contribution of the E-Academy of the Future Project in the process of shaping key competencies as the element of the life-long learning process among middle school learners in Poland is undeniable. The evaluation has proved that pupils found the e-learning materials interesting; yet, they preferred when the units were connected with the topics discusses in the classroom (Kalinowska 2013). This shows that they associated the online materials with their obligatory school work or even workload. Perhaps, it was the teachers' role to encourage young learners to use the e-learning units not only as self-study material but also as a motivating tool in their pursuit of knowledge, entertainment and fun. Unfortunately, the Project's prerequisites did not allow external linking, which would definitely change the users' attitude and, in effect, expand the influence of the Project.

Although the pupils might not be able to use the EU terminology in naming the key competencies (comp. the quote above), thanks to the choice of topics and content related material, they obviously recognize and share the most important knowledge, values and skills and, moreover, thanks to this project, they associate these ideas with the modern technology usage in education. One other young user of our program said, "[For me key competencies mean] extra ambitions, knowledge that I got from the platform" (Kalinowska 2013).There can be no better gratification for the authors, whose main aim was to inspire young learners, to give them the skills and knowledge that they can later appreciate and use in their careers. In the near future, the authors plan a more detailed analysis of the Project's outcomes and a deeper and more thorough evaluation of the role of e-learning in shaping the key competencies by teachers among Polish middle school learners of English.

## REFERENCES

Collis, B., & Jung, I.S., 2003: Uses of Information and Communication Technologies in teacher education. In Robinson, B., Latchem, C. (eds.), Teacher Education through Open and Distance Learning. RoutledgeFalmer, London, 2003, pp. 171–192. ISBN: 041536955X.

- Faron-Lewandowska, E., 2013: *E-learning Units. About the Project and its Evaluation* [in Polish]. GPKK Authors Conference.
- Gadomska, A., & Krajka, J., 2011: Shaping Key Competences in Language Classes- on the Implementation of E-learning in Middle School Foreign Language Education. In E. Smyrnova-Trybulska (ed.), Use of E-learning in the Developing of the Key Competences. University of Silesia, Katowice-Cieszyn, 2011 pp. 143-148. ISBN 836007139X
- Gadomska, A., & Krajka, J., 2012: Developing Social and Civic Competences as Aspects of Intercultural Communicative Competence- E-learning for Middle School Students- a Case Study. In E-learning for Societal Needs. E. Smyrnova-Trybulska (ed.), University of Silesia, Katowice-Cieszyn, 2012, pp. 105-122. ISBN: 8360071594.
- Gadomska, A., Krajka, J., 2011: Key Competences in E-learning- E-Academy of the Future Project [in Polish] In: K. Jaworska-Biskup, B. Kijek, A. Szwajczuk (eds.), Interdisciplinarity in the Didactics of Foreign Language Teaching [in Polish]. Wydawnictwo Uniwersytetu Szczecińskiego, Szczecin, 2011, 89-108. ISBN 9788375185355
- Gadomska, A., Morusiewicz, R., & Krajka, J., 2012: Shaping Key Competences in E-learning as Means of Individualizing Foreign Language Teaching [in Polish]. In: J. Knieja, S. Piotrowski (eds.), Foreign Language Teaching and Special Needs of Learners. Key Competences, Motivation and Strategies [in Polish]. Towarzystwo Naukowe KUL/Katolicki Uniwersytet Lubelski Jana Pawła II, Lublin, 2012, pp. 425-441. ISBN: 8373065458
- Grela, E., 2013: *Project Realization in the Years 2010/2013* [in Polish]. GPKK Authors Conference
- Jung, I., 2005: ICT-pedagogy integration in teacher training: application cases worldwide. Educational Technology & Society, 8 (2), 94–101. ISSN 1436-4522.
- Kalinowska, M., 2013: *E-Academy of the Future Ex-post Evaluation. Selected Issues.* [in Polish]. GPKK Authors Conference
- Okońska-Walkowicz A., 2009: Shaping Key Competences in the Didactic Process. [in Polish] Presentation delivered during the conference: E-Academy of the Future. Middle School Program for the Development of Key Competences. Warsaw, 2009, available at http://www.eakademiaprzyszlosci.pl /pub/files/Wystapienia/Ksztaltowanie\_kompetencji\_kluczowych\_w\_procesie\_d ydaktycznym.ppt (accessed on 30 July 2013).
- Recommendation of the European Parliament and the Council of 18 December 2006 on Key Competences for Lifelong Learning (2006/962/EC). Official Journal of the European Union. European Commission, Strasbourg, 2006, available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:

L:2006:394:0010:0018:en:PDF (accessed on 30 July 2013).

Szafraniec, K., 2011: *Youth 2011* [in Polish]. The Chancellery of the Prime Minister. Press Center.[in Polish]. Available at http://www.premier.gov.pl /centrum\_prasowe/wydarzenia/raport\_quot\_mlodzi\_2011\_quot\_,7530/ (accessed on 30 July 2013).

## IMPLEMENTING LANGUAGE ASSESSMENT PRINCIPLES IN AN ONLINE TESTING SYSTEM

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Abstract: Apart from reducing the time needed for test scoring and analysis, a webbased testing system can support language instructors in developing effective language tests. In particular, online technology has the potential to assist them in making valid score interpretations and dependable mastery/non-mastery decisions. However, technology alone will not guarantee high-quality tests – these must be properly developed in accordance with the fundamental principles of language assessment. This article takes a look at the basic assessment principles and demonstrates how they can be implemented in an online testing system.

Keywords: e-testing, web-based test development, assessment principles

## **INTRODUCTION**

Rather than being used solely for measurement and evaluation, language testing (whether traditional or web-based) should inform learning and teaching. Yet for this to be the case, the quality of measurement instruments must be as high as we can possibly make it. In order to ensure high quality language tests, it is essential that their construction be in keeping with the underlying principles of language assessment. Using the WebClass platform as an example, this article focuses on the application of assessment principles to web-based language testing, and emphasizes the facilitating role of online technology in the entire process of test development.

#### **1. WEBCLASS**

WebClass (Malec 2012) is an online, database-driven e-learning and e-testing system implementing PHP/MySQL and JavaScript/AJAX technologies. Its features include administration, basic communication, content authoring, and assessment. The system is used in blended learning environments with students of English

philology at the John Paul II Catholic University of Lublin and the State School of Higher Professional Education in Zamość.

The e-testing component of the platform can be used as an independent module to construct, administer, and analyze online assessments. The key part of test construction is the writing and evaluation of test items, whose types at WebClass range from selected response (true/false, multiple choice, multiple-choice cloze, multiple correct, matching), through limited production (cloze, gap-filling, transformations, error correction, short answer), to extended production (composition). When the items are compiled into a test form, they can be assigned to registered users, who respond to them online and submit their answers to the database. The answers can then be marked either automatically (selected and limited production types) or by the tester (compositions). At any time throughout the course, for both the instructor and the students, tabulated reports (with grades) can be dynamically generated upon access. Such reports include all test results and (optionally) attendance and self-assessment scores, as well as any other (e.g. paperand-pencil) assessment results, which may be manually entered into the system. Instructors also have the option of analyzing the tests statistically in order to find out whether they are consistent with the quantitative principles of measurement.

## 2. ASSESSMENT PRINCIPLES

This section takes a look at the basic principles of language assessment (as identified and discussed by Brown 2004), including practicality, reliability, validity, authenticity, and washback. These principles can be used as criteria for evaluating the usefulness of an existing assessment instrument by means of qualitative and quantitative analyses.<sup>1</sup> More importantly, however, they permeate and impact on the entire test development cycle: from test design, through operationalization, to administration (for more on stages of test development, see, e.g., Bachman and Palmer 1996; Hughes 2003; Fulcher 2010). The overall aim here is to demonstrate that an online testing system can greatly facilitate the application of (at least some of) these principles to language test development.

#### **2.1 Practicality**

A test is considered to be practical as long as it "is not excessively expensive, stays within appropriate time constraints, is relatively easy to administer, and has a scoring/evaluation procedure that is specific and time-efficient" (Brown 2004: 19). Online assessments have definitely more to offer in terms of practicality than do traditional paper-and-pencil tests.

First, tests at WebClass do not always have to be constructed by writing new items from scratch: existing (previous) items can be imported from a bank, or from

<sup>&</sup>lt;sup>1</sup> Qualitative analysis involves making subjective judgments about the effectiveness of items or tasks, and relies to a large extent on common sense. Quantitative analysis, on the other hand, consists in calculating and interpreting item and test statistics.

another test. It is also possible to speed up the process of item writing by editing the questions in an HTML editor and then converting them to test items proper using a text-to-items converter. A test creator wizard is also available, which makes the process of test construction fully automated – the wizard retrieves random items from one or more item banks and puts them in a user-defined number of item sets.

Moreover, web-based tests score highly in the area of easy delivery and scoring efficiency. It is a fact long recognized that a web browser is everything that students need in order to take online tests and quizzes "whenever and wherever it is convenient" (Roever, 2001: 88). On the instructor's side, test practicality is significantly enhanced by the possibility of using automated scoring procedures. At WebClass, in the case of limited production items, it is not only the (perfectly) correct responses that are given credit automatically – the test constructor can also specify other acceptable (e.g. partially correct) answers, as seen in Figure 1:

I didn't know she was ill or I would have gone to see her. If only - gap -	to see her.
Also full score: • I had known about her ilness I would have gone	ACCEPTABLE 🖨 CORRECT
Half score: • I had known she was ill, I would have	] ×
General Feedback:	General 🖨 Specific
This is the third conditional (if only + past perfect) used to exp	ress regrets.
DELETE ITEM Spelling errors permitted for 1/2: 2 -	Ignore: 🔽 Capitals 🗹 Spaces 👽 Punctuation

#### **Figure 1. WebClass test editor showing part of a transformation item** Source: http://webclass.co/tests\_edit/?test\_id=1395

The figure illustrates a transformation item (taken from a grammar test) eliciting the completion of a paraphrase of the sentence *I didn't know she was ill or I would have gone to see her*. The expected response is *I had known she was ill, I would have gone* (not displayed in the figure). However, one student supplied *I had known about her ilness I would have gone*, which is not exactly the expected response and, additionally, one word is misspelt. Nevertheless, the instructor decided that, since the grammatical structure was fine, this particular answer merited full credit. Such a change to the key can be made with a single click of a button after the test has already been administered, while verifying the automatic marking. When the test is

opened in the editor, as in Figure 1, the acceptable answer is displayed under 'Also full score'. Similarly, answers which merit partial credit (half a mark) can be added to the scoring rubric either at the construction or at the verification stage of test development. Half a mark can also be awarded automatically for 'imperfect' responses as long as they do not contain more misspelt characters than the number selected by the test constructor (error level for  $\frac{1}{2}$ ), which equals 2 in the case of the item in Figure 1. In addition to this, the scoring algorithm can be set to completely ignore capital letters, spaces, and punctuation.

As far as extended responses are concerned, these have to be marked manually at WebClass in a window containing a simple HTML editor, where the tester can mark errors and insert comments. The features which can potentially contribute to test practicality include the possibility of looking up mouse-selected text in the BNC (British National Corpus) or in Google Books (useful for checking collocations) as well as a plagiarism detection script (see Malec, forthcoming, for more on this).

Finally, online testing constitutes a radical change in the way quantitative analysis can be carried out by school teachers. This type of test analysis requires individual item scores (ones, zeroes, half points, etc.), yet it is hard to imagine overworked teachers entering hundreds of values into, e.g., Excel spreadsheets on a daily basis. At WebClass, a number of statistics are calculated automatically (see below). Additionally, test scores can be downloaded as comma-separated variables (CSV files) for further analysis.

#### 2.2 Reliability

In language testing, the higher the degree to which test scores are free from errors of measurement, "the greater the relative effect of the language abilities we want to measure, and hence, the reliability of language test scores" (Bachman 1990: 160). In other words, we want individual variability in test performance to be due to actual changes in ability rather than differences in test tasks, administrative procedures, raters, or factors such as mood, fatigue, lack of interest, etc. Generally speaking, reliability pertains to "consistency of pupil performance and consistency in assessing that performance" (Gipps 1994: 67).

In online testing, thanks to automated scoring procedures, the potential source of unreliability stemming from the fact the humans can make errors when marking tests (cf. Fulcher 2010: 46) is eliminated. The scoring algorithms make sure that all of the students who submit identical answers get identical scores. At WebClass, rater reliability is further ensured at the verification stage (see also the previous section), as illustrated in Figure 2:

If only I to my father's advice, I'd be a successful lawyer by now.		
KEY: had listened;		
Incorrect answers:		
Aleksandra Nowak, Piotr Seńko, Nataliia Wiśniewska, Julia Myślińska, Viktoria Romanek,		
Anastasiya Petrowa, Aneta Kowalska, Roman Jabłoński, Zenon Kowalczyk		
listened		
Add to key Mark: 0 Override marking: 1 point 0.5 point		
Perhaps, generally, but more likely "in the past".		

#### Figure 2. Verification of the marking

Source: http://webclass.co/tests\_verify/?test\_id=1395

In the test verification window, for each test item, incorrect answers are displayed together with all of the test takers who submitted them. If the tester overrides the automatic score (by clicking '1 point' or '0.5 point'), the change applies to all of the relevant test takers.

Reliability statistics are calculated at WebClass when a test analysis window is opened. An example is given in Figure 3:

Passive voice	
Average time: 28 min. 48 s.	
Test Statistics:	
Number of test takers (submissions): n = 30	Cronbach's alpha (NRT): $\alpha$ = 0.88276
Number of items (highest possible score): $k = 40$	Spearman-Brown prophecy (NRT): r = 0.89510
Cut-score: $\lambda = 24.0$	Standard error of measurement (NRT): SEM = 6% (2.2 pts.)
Mean: x = 24.55000	The phi coefficient (CRT): $\Phi = 0.82061$
Mean of proportion scores: $\tilde{x}_{p} = 0.61375$	Phi lambda & kappa squared (CRT): $\Phi_{\lambda}$ = 0.80176; $\kappa^2$ = 0.88358
Standard deviation: S = 6.57058	Confidence interval (CRT): CI = 8% (3.1 pts.)

#### Figure 3. Test statistics

Source: http://webclass.co/tests\_stats/analysis.php?test\_id=1361

The statistics, which include both norm-referenced and criterion-referenced reliability estimates, can help the test developer to evaluate the quality of the assessment instrument. For example, the values of phi lambda and kappa squared indicate the degree to which mastery/non-mastery decisions made on the basis of test scores are dependable (for more on these and other statistics, their calculation and interpretation, as well as differences between norm-referenced and criterion-referenced testing, see Brown and Hudson 2002; Bachman 2004).

#### 2.3 Validity

Reliability and validity should be seen as "complementary aspects of a common concern in measurement – identifying, estimating, and controlling the effects of factors that affect test scores" (Bachman 1990: 160). Alderson *et al.* (1995) explain the relationship between the two concepts in the following way:

In principle, a test cannot be valid unless it is reliable. If a test does not measure something consistently, it follows that it cannot always be measuring it accurately. On the other hand, it is quite possible for a test to be reliable but invalid. A test can, for example, consistently give the same results, although it is not measuring what it is supposed to. Therefore, although reliability is needed for validity, it alone is not sufficient. (Alderson *et al.*, 1995: 187)

High reliability of a test is not an end in itself, and calculating it should be regarded as "part of a unified approach to establishing the overall validity of a test" (Weir, 2005: 43). It is now widely recognized that certain aspects of reliability and validity may be virtually indistinguishable from each other, as in the case of parallel forms reliability and concurrent validity (Alderson *et al.* 1995: 188). In this sense, it does not ultimately matter whether the evidence that is produced in support of the usefulness of a test pertains to reliability or validity, although the distinction between the two concepts is usually maintained simply for clarity and neatness of presentation. What does matter is that assessment instruments should be inspected from many different angles in order to make sure that the scores they produce are as accurate as possible a reflection of test takers' knowledge and ability. Obviously, no test is perfect, and test scores will always contain some error. Tests may also vary on certain aspects of validity from one administration to another, or from one group of test takers to another. In short, validity is a matter of degree and a relative rather than absolute concept (Messick 1989; Weir 2005).

In classroom testing, and arguably in most distance-learning contexts, the major sources of evidence for test validity are content validity and construct validity (cf. Brown and Hudson 2002: 212; Brown 2004: 32). In short, the former refers to the extent to which test items are representative of the course content and learning objectives, whereas the latter relates to the degree to which the test actually taps into the psychological construct that it purports to be measuring. Evidence for content validity is sought through qualitative analysis, while evidence for construct validity may come from correlational approaches such as the multitrait-multimethod matrix

(Campbell and Fiske 1959) and factor analysis, as well as from intervention and differential-groups studies (Brown and Hudson 2002).

As mentioned above, the testing system at WebClass offers the possibility of exporting test scores to a .csv file, from which they can be easily transferred to a statistical software package such as SPSS for advanced analyses. However, basic item analysis is carried out in the same window which displays reliability estimates. It includes one statistic that is particularly useful for detecting items which might not measure what they are supposed to measure. Consider the results of item analysis given in Figure 4:



#### Figure 4. Multiple-choice item analysis

Source: http://webclass.co/tests\_stats/analysis.php?test\_id=171

The *B*-index is a simple statistic which tells us how successful a given item was at distinguishing masters (students who passed the test) from non-masters (those who failed it). A negative value of this statistic indicates that the item analyzed was more difficult for masters than for non-masters, contrary to what we would actually expect. On closer inspection, it turns out that the item in Figure 1 does not measure grammatical knowledge only, because option A is grammatically correct, even if it does not make sense. It follows, then, that the item taps logical thinking, in addition to grammatical knowledge. Since the test as a whole was supposed to measure knowledge of lexico-grammatical structures, the item in question was perhaps a bit of a misfit.

## 2.4 Authenticity

Authentic test tasks are those which are similar to some tasks in the target language use domain (real world). According to Brown (2004), test authenticity can be increased by using natural language, contextualized items, meaningful topics, by connecting items through a story line, and by making sure that they simulate real-world tasks. In addition, they can be made more authentic through the provision of multimedia (Chapelle and Douglas 2006).

Certain web-based methods of assessment are arguably more authentic than their paper-and-pencil counterparts. A case in point is the assessment of writing ability. One of the things that the test developer has to consider is the fact that these days hardly any text is hand-written. Official documents, for example, are either submitted using online forms, email, etc. or typed on the computer and printed out. Indeed, written communication is nowadays mostly computer-mediated (emails, social networking services, chat rooms, etc.). It follows then that test tasks requiring students to enter the text on the computer are somewhat more authentic than analogous paper-and-pencil ones. By the same token, web-based assessments of writing ability (consisting of, e.g., tasks eliciting an extended response, such as a letter) satisfy the criterion of authenticity by virtue of simulating real-world tasks.

#### 2.5 Washback

Washback in language testing generally refers to the influence of testing on learning and teaching (e.g. Bailey 1996). The common belief that "good test scores equal good education" (Popham, 2001: 16) often gives rise to 'teaching to the test', i.e. improving test results instead of diagnosing learners' strengths and weaknesses. Brown (2004) points out that "[o]ne way to enhance [positive] washback is to comment generously and specifically on test performance" (p. 29).

Online testing readily lends itself to the requirements of assessment *for* learning, defined by Black *et al.* (2004: 10) as "any assessment for which the first priority in its design and practice is to serve the purpose of promoting students' learning" (see also, e.g., Chappuis and Stiggins 2002; Cauley and McMillan 2010; Wiliam 2011). One of the key components of such assessment is the provision of effective feedback on students' progress towards the learning objectives. Using the WebClass testing system, two types of feedback can be provided: general and response-specific. General feedback contains some extra information on the content of the test item; it is always provided irrespective of the response. Response-specific feedback, on the other hand, is the comment that students receive when their response matches the one for which the feedback is intended. Test takers can view and study the feedback immediately upon completion of the tasks, or later as a homework assignment.

Brown (2004: 37) suggests that beneficial washback can also be achieved by encouraging students to set their own learning goals and engage in self-assessment. Both of these practices are formalized at WebClass: students can define their own learning objectives (in addition to those set by the instructor) and then evaluate their learning outcomes (by indicating how well they have done on each objective) on a predefined scale. The results of student self-assessment can optionally be included in the calculation of the final semester grade.

## CONCLUSION

This article has presented a short review of the five principles of language assessment outlined by Brown (2004). Of all the principles in question, discussed here in the context of web-based testing, validity is arguably the most fundamental one: test developers need to make sure, first and foremost, that test scores are accurate indicators of whatever the test claims to be testing. Guidelines on achieving this apply in equal measure to both online and paper-and-pencil testing:

For validity to be high, the assessments should sample students' performance on each objective, an appropriate mix of assessment methods should be used, and
assessment methods should be selected on the basis of providing the truest picture possible. (Morgan and O'Reilly, 2006: 95)

Conceptually, web-based testing as exemplified by the WebClass system does not constitute a major departure from traditional paper-and-pencil testing: online test development needs to follow the same well-known principles of assessment. The difference that web-based technology really makes is in the area of practicality: time saving (with respect to test construction and quantitative analysis), easy delivery, and scoring efficiency.

#### REFERENCES

- Alderson, J., C., Clapham, C., and Wall, D., 1995: Language Test Construction and Evaluation. Cambridge: Cambridge University Press, ISBN: 9780521478298.
- Bachman, L., F., 1990: Fundamental Considerations in Language Testing. Oxford: Oxford University Press, ISBN: 9780194370035.
- Bachman, L., F., 2004: *Statistical Analyses for Language Assessment*. Cambridge: Cambridge University Press, ISBN: 9780521003285.
- Bachman, L., F., and Palmer, A., S., 1996: Language Testing in Practice: Designing and Developing Useful Language Tests. Oxford: Oxford University Press, ISBN: 9780194371483.
- Bailey, K., M., 1996: Working for washback: a review of the washback concept in language testing. *Language Testing* 13, pp. 257–279, ISSN: 02655322.
- Black, P., Harrison, C., Lee, C., Marshall, B., and Wiliam, D., 2004: Working inside the black box: Assessment for learning in the classroom. *Phi Delta Kappan* 86(1), pp. 9-21, ISSN: 00317217.
- Brown, H., D., 2004: Language Assessment: Principles and Classroom Practices. White Plains, NY: Pearson Education., ISBN: 9780130988348
- Brown, J., D., and Hudson, T., 2002: *Criterion-referenced Language Testing*. Cambridge: Cambridge University Press, ISBN: 9780521000833.
- Campbell, D. T. and Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin* 56, 81–105, ISSN: 00332909.
- Cauley, K., M., and McMillan, K., H., 2010: Formative assessment techniques to support student motivation and achievement. *The Clearing House* 83(1), pp. 1-6, ISSN: 00098655.
- Chapelle, C., A., and Douglas, D., 2006: Assessing Language through Computer Technology. Cambridge: Cambridge University Press, ISBN: 9780521840217.

- Chappuis, S., and Stiggins, R., J., 2002: Classroom assessment for learning. *Educational Leadership* 60(1), pp. 40-43, ISSN: 00131784.
- Fulcher, G., 2010: *Practical Language Testing*. London: Hodder Education, ISBN: 9780340984482.
- Gipps, V., C., 1994: Beyond Testing: Towards a Theory of Educational Assessment. London: Falmer Press, ISBN 9780750703291.
- Hughes, A., 2003: *Testing for Language Teachers* (2nd edition). Cambridge: Cambridge University Press, ISBN: 9780521823258.
- Malec, W., 2012: *WebClass* [online learning management system]. Available at http://webclass.co (Accessed on 15 June 2013).
- Malec, W., (forthcoming). On the potential of web-based assessment of language skills. In H. Chodkiewicz and M. Trepczyńska (eds.), *Language Skills: Traditions, Transitions and Ways Forward*. Newcastle upon Tyne, UK: Cambridge Scholars Publishing, ISBN: 9781443853187.
- Messick, S., 1989: Validity. In R. L. Linn (ed.), *Educational Measurement* (3rd edition, pp. 13–103). New York: Macmillan, ISBN: 9780029224007.
- Morgan, C., and O'Reilly, M., 2006: Ten key qualities of assessment online. In M. Hricko and S. L. Howell (eds.), *Online Assessment and Measurement: Foundations and Challenges* (pp. 86-101). Hershey: Information Science Publishing, ISBN 9781591404989.
- Popham, W., J., 2001: The Truth About Testing: An Educator's Call to Action. Alexandria, VA: Association for Supervision and Curriculum Development, ISBN: 9780871205230.
- Roever, C., 2001: Web-based language testing. *Language Learning & Technology* 5(2), pp. 84-94, ISSN: 10943501.
- Weir, C., J., 2005: Language Testing and Validation: An Evidence-based Approach. Basingstoke: Palgrave Macmillan, ISBN: 9781403911896.
- Wiliam, D., 2011: What is assessment for learning? *Studies in Educational Evaluation* 37(1), pp. 3-14, ISSN: 0191491X.

# DIGITAL HANDBOOKS OVERVIEW OF AVAILABLE OPTIONS

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Abstract: This article presents the present author's modern concept of e-textbooks. The modern e-textbooks proposed by the author have a layered structure. Educational spaces are made up of any number of multimedia and interactive elements that can be freely composed by creators and teachers. In addition, an ebook can be played on different types of mobile devices, which also corresponds to the rule of knowledge on demand

Keywords: e-learning, e-learning platform, digital handbook, e-books, multimedia.

#### **INTRODUCTION**

In many European countries, including Poland, there is a debate on the introduction of e-textbooks to schools. This issue is being analyzed in both essential (usability, range of using, pros and cons) and economical (cost of introduction and support) areas. The debate is an effect of on-going digitalization of our lives. In many European countries, the idea of e-textbooks is being processed at a decision stage, not to mention the countries which have already implemented it in schools. The presented information describes the actual situation in Europe, based on the data from the Ministry of National Education – Euridice Polish Office.

In France, the project similar to "Digital School" is in its pilot phase. The French Department of Education has tested the usability of e-textbooks since 2009. This year, the experiment will cover about 20 000 pupils and their teachers in high schools. In the process of developing new solutions, the Department cooperates with publishers, online educational platforms, and ICT tools producers. The program is sponsored by local authorities and central government institutions. E-textbooks are being prepared for courses like History, Geography, and French language. They include a lot of graphics, audio and video add-ons. The teacher has access to an administrative panel, which allows to choose elements included into classes. Pupils can use materials in many places via the Internet– at home, at school, libraries – everywhere they have access to computers (their own, supplied by school or local

authorities in the project). E-textbooks are not available at traditional publishers' market.

In Sweden, there is no central system of verification and acceptance of textbooks by the Ministry of Education. It is the teacher who decides on using educational materials. It is his decision whether to use traditional books, electronic materials, or not to use any of them during classes. On the other hand, there is a wide-ranging discussion in Sweden on e-textbooks, caused by authorities of one of schools in Sollentuna region. Children in this school learn to read and write using tablets until the age of 8. This idea has been criticized by the Ministry of Education, and widely on the Internet, but the school is determined to continue the project, and assigned the equivalent of 6 000 000\$, which balances financing traditional paper books in this school.

In Finland there is a system which is similar to Swedish one. Teachers decide which materials they use in their lectures. There are e-textbooks available, which have been created mainly for students with special educational needs.

The situation in Great Britain is a reflection of the one in Scandinavian countries – teachers are to choose materials by their own. And same as in Scandinavia, there is no official record of using e-textbooks in education. However, in 2010 the national research institute Becta conducted an interesting study which showed that more than 50% of teachers regularly use online educational materials and give home assignments based on these resources.

In Portugal, Belgium (French regions), Scotland and the Czech Republic there dominates the traditional textbook market, though some teachers use educational materials available on the internet.

In Slovakia, in 2010 the Ministry of Education inaugurated the *eAktovka* program. Its aim is to create an educational portal with books and other educational materials, including video and audio version. Since January 2012, the users have been testing the portal, and the ministry is buying licenses allowing for publishing books on the portal. The ministry wants all the resources necessary for learning at all levels of education to be available at the platform in the future, although it is difficult to predict the opinions of the editors in this case. A similar pilot program is carried out in Austria.

In Iceland in schools at primary level there are two pilot projects, including one for students aged 14 and 15 years. First of all, the program checks the potential of tools such as the Kindle and iPad. In this country, educational materials via the Internet are widely used, supported by wide access to the central database and a schools' network.

Greece, thanks to the European Union funds, also launched a *Digital School* program. It involves spreading e-books, equipping the studio with modern equipment and educating teachers in the use of new technologies. E-books are

construed as traditional manuals in pdf. At present they are spreading and are used since the first grade of primary school.

In Lithuania publishers are encouraged to create digital versions of resources, although they are reluctant to do so. Existing e-textbooks are used only at the stage of primary school. Lithuanians emphasize that e-books are still functioning in parallel with traditional books, adding the fact that the first e-book without the paper counterpart will soon become available on the market, designed for learning the Lithuanian language by ethnic minorities.

In Cyprus, the majority of textbooks is present on the market in both pdf and traditional version. In 2012, the Ministry of Education sent a part of such digitized books to secondary schools and vocational schools. In March 2012, some schools have launched a program in which the students bring their laptops to school once a week. By the end of the school year, teachers will develop recommendations and proposals for lesson plans using laptops in the classrooms.

In Bulgaria, a new bill on the education system has been prepared, aiming at systematization of the use of electronic books. But it is not planned to implement them as an independent and unique resource - the schools will still apply traditional printed books, and all e-resources will be regarded as complementary.

Latvia uses primarily traditional textbooks, and electronic materials are auxiliary. Teachers are encouraged to use the e-resources, especially in classes with physics, chemistry and biology. But ultimately it is the teacher who decides on the type of textbooks. In addition, the National Center for Science Education approved electronic educational materials about the European Union, which can be used in lessons of Social sciences, History, Ethics and Geography.

In Italy, they use textbooks, which are available either in an electronic form only, either traditional and electronic. The Ministry of Education provided the technical requirements of the publishers of such resources, so that their use is standardized.

In Spain, despite the lack of regulations on e-books, and of the lack of statistics of using new technologies, autonomous regions implement education programs aimed at digitizing school reality. In Andalusia, in the school year 2011/2012, a pilot program was implemented for primary and secondary schools, which was attended by 90 schools. They developed the concept of digital resources and planned to use them during the lesson. In Catalonia, *EduCAT* program for 10 - and 12-year-olds was developed, which equipped pupils with a computer infrastructure and e-books.

In Slovenia, like in Poland, the manuals must be approved for use in schools by the central functioning expert council. The use of particular textbooks in the classroom is possible after consultation with parents. The first e-textbooks were approved in November and December of 2011, so their use is not yet popular. Approved for use, e-textbooks have been prepared for the activities of environmental education in the first three grades of primary school. In the sixth, seventh, and eighth grade students

can enjoy the e-textbooks during lessons of art and technology. Interestingly, these e-books do not have their traditional equivalent books<sup>1</sup>.

The above results of the research by the Polish Ministry of Education present a variety of concepts of e-textbooks in European environment. They show a multitude of e-textbook definitions, from the digitized form of traditional book, coming from the 1:1 transfer of the traditional book to digital to more elaborated ones including parallel operation of two types - e-book media, compatible with the traditional, but going beyond it by possibilities of instructiveness and multimedia available from various carriers. A third possibility - according to the results of MEN - is e-book independent of the traditional textbook in terms of program, as well as multimedia and interactive qualities. Facing the multiplicity of the concepts of creating e-textbook, the question is: what should the Polish e-textbook be like?

# **1. REVIEW OF E-TEXTBOOKS**

Modern publishers and technology companies offer a variety of solutions for etextbooks. This diversity is the result of the subsequent interpretation of the ehandbook and diverse understanding of the needs of teachers and the educational market. Some available solutions were established a few years ago, for example in academic centers, and is adapted to the current needs.

To update the issue, the following criteria for evaluating the concept of e-textbook have been taken into consideration:

- 1. Multimedia Equipment Manual in multimedia elements such as videos, animations, simulations.
- 2. Interactivity the handbook containing elements of active use, such as running interactive quizzes, experiments that provide interactive results, etc.
- 3. Availability from various devices the ability to play your textbook and/or its fragments from a device such as a computer/laptop/netbook, tablet, interactive whiteboard.
- 4. The ability to print content/e-textbook passages to print any part of the materials, for example, indicated by the teacher part of an e-book.
- 5. Integration with e-learning platform the opportunity to publish an etextbook on e-learning platform, and thus gain access to information on the results of the use of both whole textbook and its parts.
- 6. The integration with the educational and/or social portal availability of etextbook from educational portal from anywhere at any time, with the possibility of expanding e-textbook with additional materials, such as links to the latest developments with the use of social and communication channels.

<sup>&</sup>lt;sup>1</sup> Source: *E-podręczniki w Europie*, http://www.men.gov.pl

<sup>(</sup>full link: http://www.men.gov.pl/index.php?option=com\_content&view=article&id=3191%3Ae-podrczniki-w-europie-&catid=97%3Aksztacenie-i-kadra-edukacja-informatyczna-i-medialna-default&Itemid=134).

- 7. Correlation with a traditional textbook program and content in line with traditional, paper version of handbook.
- 8. Ability to do self-control, self-assessment and self-verification tests straight from the e-textbook.
- 9. Navigation ability to navigate through the textbook, in either linear or random form.
- 10. The ability to create the content of textbook with resources available in ebooks or from their own teaching materials for any batch of material, such as a lesson.

As a result of the analysis of the criteria e-textbook must meet, and within the available solutions on the market, the following summary has been developed.

#### Table 1.

Statio	Ideas Transforming the traditional manual into an electronic
Static	fuea: fransiorming the trautional manual into an electronic
e-textbook	format
	•Static - mostly in pdf format
	•It is the traditional textbook 1:1 mapping
	•Has the ability to print
	•Has the ability to place it on the e-learning platform without
	treaking the use of a textbook at the level of its ports
	tracking the use of e-textbook at the level of its parts
Multimedia	Idea: Transforming the traditional manual into an electronic
enhanced	format, a simple, quick publication of educational resources
static	•Static - mostly in pdf format
e-textbook	•It is the traditional textbook 1.1 mapping frequently with
e tentooon	traditional pages layout
	Puilt on a concentual level of static material
	-Dunt on a conceptual level as static material
	•Ennanced with multimedia
	•It has poor, mostly linear navigation
	•Has the ability to print selected parts
	•Has the ability to place it on the e-learning platform, without
	tracking the use of e-textbook at the level of its parts
Multimedia e-	Idea: Creating a fully multimedia textbook at the level of
textbook	concept
	•Has the ability to place it on the e-learning platform, with
	tracking the use of e-textbook at the level of its parts or as a
	whole
	•Has stenwise navigation
	•Constructed completely multimedially including the division of
	constructed completely multimedia asso
	content, graphics and multimedia case
	•Enriched with advanced multimedia elements, animations,
	simulations, etc.
	•Has the ability to print selected parts

#### Typology of available e-textbooks

Interactive e- textbook	The idea: To create completely multimedia textbook already at the level concept •Has the ability to place it on the e-learning platform, with tracking the use of e-textbook at the level of its parts or as a whole •Has stepwise navigation •Designed interactively, divided into layers of substance and multimedia •Ensures implementation of interactive exercises •Provides ongoing cooperation of user with textbook •It creates the possibility of placing textbook on the educational / social portal
	•Allows using the textbook from multiple devices
Intelligent e- textbook	<ul> <li>Idea: Provide teachers with a flexible tool with which one can build own lessons content based on available resources, with the ability to use the basic version or modifiable</li> <li>Has the ability to place textbook on e-learning platform, with the option to track the results of its use (the use of the textbook or any of its parts)</li> <li>Gives the ability to modify the basic version by changing the layout and sequence of content, complementing additional materials, including own materials</li> <li>Ensures implementation of interactive exercises</li> <li>Provides ongoing cooperation of user with textbook</li> <li>It creates the possibility of placing textbook on the portal educational / social</li> <li>Allows the use of the textbook from multiple devices</li> <li>Gives ability to print selected parts</li> <li>Built-in stepway navigation</li> <li>Designed interactively</li> </ul>

Source: own work, Marlena Plebańska

As the above analysis shows, there are many opportunities to develop e-textbook, ranging from static solutions which are mostly digitalized version of the traditional textbook, to the intelligent material that gives teachers the possibility to select the content of the lesson, with the use of resources library, which can also be used to create multi-course lessons. In Poland, the most frequently used solution is intermediate, such as multimedia e-book. Advanced multimedia textbooks are still very rare. There is also a lack of knowledge on modern technological solutions available among textbooks creators.

So, what should an ideal e-textbook be like? Unfortunately, there is no such thing as an ideal e-textbook. Electronic textbook, according to very short lifecycle, is usually up to date for 2-3 years. And while the content usually remains valid, technology used becomes outdated. New materials, more interactive, more multimedia, appear on the market.

# 2. PROPOSITION OF E-TEXTBOOK MODEL.

In the construction of e-textbook it is difficult to give a final judgment, because the models become outdated as quickly as the tastes and needs of consumers. And although it might seem that the Polish school is quite numb as an institution, the community of teachers and students are increasingly discovering the need for interactive content available from anywhere, anytime. Therefore, the model tailored to current needs is presented in Figure 1.





### Source: own work, Marlena Plebańska

This proposal is based on the concept of placing an e-textbook on an e-learning platform coupled with an educational portal. This type of access to textbooks allows you to use them from anywhere, at any time, from different types of devices with just a browser. In addition, it ensures the implementation of all processes typical of educational portals: the creation of an information service, all the latest news of subject, meetings with experts, communication, social contacts. The connection of an educational portal with an e-learning platform gives you first of all an opportunity to observe not only the use of the textbook, but also its parts. It also provides an opportunity to implement the processes typical of e-learning platforms, such as user

management, management of content available on platform, reporting, updating and expanding the content, synchronous and asynchronous communication.

The presented concept assumes that the e-learning platform e-book is available in the basic version, ready for automatic use, closing an arrangement of chapters and lessons. But it can also be suitable for immediate use as components (text, video, graphics, animation, audio, exercises, games, etc.) from which the teacher can independently create their own lessons, including multi-subject ones. If the teacher lacks certain elements, he can create them himself using a simple tool. Content of the e-textbook is based on system of scenarios of components and program content, proposed by the author as the original. Both the use of ready-made lessons and creating their own offers great opportunities for teachers to adapt the content to the needs - the specific target group, and preferred methods and techniques of driving lessons. It also offers possibility of rapid updating and continuous improvement to textbook as necessary, for example if you change the core curriculum.

# 3. MODERN E-BOOK - CONCEPT

The e-textbook concept assumes that the e-manual is composed of three levels synchronized with each other. The first layer is a repository that consists of three basic parts:

- **Global repository** here are stored various globally available components of e-textbook, divided into categories.
- Own repository here are stored components of e-textbook, which have been prepared by teacher. These components are also divided into categories.
- **Textbook casing** here are stored additional, optional casing components of e-textbook, which have been defined for subject or age group.

The core repository consists of components of the content. The main types of components of contents in the e-textbook are:

- Texts
- Graphics
- Animations
- Simulations
- Movies
- Exercises
- Games
- Tasks Test

The second level of e-textbook are content interfaces, from which the users of e-textbook, mainly teachers and students, will be able to use the standard content

recommended by the e-textbook authors. It is important to ensure individual learning process and adapting the e-textbook to tutor's teach cycle. In this model, the teacher will be able to implement his own contents and components to e-textbook, and then create their own layout of the content of e-textbook containing both components prepared by the creators of e-textbook as well as their own.

The third level of e-textbook is content management environment for e-textbook and its users. Using the functionality available in the environment, teachers will be able to create virtual classrooms in which they will work in a virtual space with their students, based both on the e-book and a number of features to support its use, such as: synchronous and asynchronous communication channels (such as forum, chat, webinar), system of reporting performance and efficiency of student work, calendars, mailing lists, news service, group work, etc.

Suggested scheme of e-textbook is presented in Figure 2.



Figure 2. E-textbook scheme

Source: own work, Marlena Plebańska

The first level of repository is the base of content components that are dynamically retrieved by a second layer - interface - form the core content of an e-book. The content created by the authors of the second level also goes into the repository. The contents of an e-textbook case are used by teachers in any way using their dynamic availability at the interfaces level, compatible with the chosen by teacher standard layout or his own content. At the third level, teachers dynamically build virtual classrooms for their students, as well as a communication system, a method for monitoring the work processes and evaluation, on the basis of the available functions. All three levels of e-textbook are closely linked on the technological and utility level, which is demonstrated in Figure 3.



Figure 3. Diagram of cooperation between the different layers of e-textbook

Source: own work, Marlena Plebańska



# Figure 4. Availability of e-textbook levels scheme

Source: own work, Marlena Plebańska

Not all the levels of e-textbook are visible to everyone. The first level of the repository is directly available only to the authors and editors of e-textbooks. However, the results of their work, that is produced educational content in various

forms of multimedia, are available for users (mainly teachers and students) at the level of interfaces as standard and / or copyrights components of an e-book.

Figure 4 shows the availability of e-textbook levels for key target groups of its customers.

E-textbooks may be used in different ways. The basic form of usage is online work with an e-textbook which is accessible from various devices such as PC, laptop, netbook, tablet, phone, board multimedia e-book reader, etc.. via a web browser. Moreover, in schools where the Internet is slower, teachers and students can download the textbook at their own equipment and work with it in the offline formula. Taking into account the preferences of today's students, e-textbook will also be available as a native app or a free app available on the android system, ios, Win 8, from the students' favorite places such as Android Market, the App Store or iTunes U. Teachers and students will be able to print any e-textbook items at their discretion.

Figure 5 presents possibilities of using e-textbooks.





Source: own work, Marlena Plebańska

# CONCLUSION

The presented possibilities of the e-textbook demonstrate a broad perspective it is perceived and the way to use and develop it by teachers. Although the concept of etextbook was based on consideration about the needs of the school learning environment, it can be successfully used in the academic or business groups, because it is flexible and adaptable to different environments, taking advantage of easy adapting to many kinds of needs. Thus, the process of implementation and use of the proposed model of e-textbook will be dictated by the needs and processes carried out by the implementing institutions.

#### REFERENCES

- Bednarek, J., 2006: *Multimedia in Education*, Wydawnictwa Naukowe PWN, Warszawa 2006. ISBN/ISSN: 83-01-14833-0
- Clarke, A., 2007: *E-learning. Learning at a distance*, Wydawnictwa Komunikacji i Łączności, Warszawa 2007. ISBN/ISSN: 978-83-206-1615-6
- Joyce, B., Calhoun, E., Hopkins, D., 1999: Models of Learning Tools for Teaching: WSiP, Warszawa, 1999. ISBN/ISSN: ISBN 83-02-07426-8
- Hyla, M., 2007: A Guide to eLearning, Wolters Kluwer Polska, Kraków, 2007. ISBN/ISSN: 978-83-7526-035-9
- Plebańska, M.: 2011: *E-Learning. Secrets of Distance Education*, C.H. Beck, Warszawa, 2011. ISBN/ISSN: 978-83-255-1920-9
- Plebańska, M.: 2010, *Economic Informatics:* C.H. Beck, Warszawa, 2010. ISBN/ISSN: 978-83-255-1764-9
- Stecyk, A., 2008: ABC of e-learning. LAMS System, Difin, Warszawa, 2008. ISBN/ISSN: 978-83-7251-879-8

# USING COMPUTER MATHEMATICS SYSTEMS IN THE LEARNING PROCESS OF COMPUTER MATHEMATICS AT PEDAGOGICAL UNIVERSITY VIA DISTANCE LEARNING

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Abstract: According to the person-centred trends in the modern society development, learner-centered technologies are implemented. Professional training of future informatics teachers is focused on the high level of information culture and future teacher readiness to use ICT in professional activities. Computer mathematics systems (CMS) are effectively used in application tasks modeling, because the computer becomes a power tool for universalization and integration of research scientific work. Special attention will be paid to the process of informatics teachers training, shaping of their knowledge, skills and competence in CMS work, and pedagogically considered usage of this in the learning course "Computer Mathematics". Hence, the distance educational course "Computer Mathematics" with using modern CMS is proposed.

**Keywords:** Computer Mathematics Systems, distance learning, e-learning, informatics science, computer science

#### **INTRODUCTION**

Under conditions of the aggravation of the social and economic, scientific-technical and cultural relationship, the society needs specialists with fundamental knowledge in the field of modern information technologies and able to use them in practical activities. PC software rapidly changes; so that skills acquired by means of regular repetition of certain actions (without fundamental principle) quickly go out of date. As a consequence, students need fundamental knowledge characterized by the maximum level of generalization and structuring (Ramsky 2003).

The relevance and feasibility of implementation and studying of Computer Mathematics at pedagogical university for the students of the specialty "Computer science" (regardless of their future professional activities such as pedagogical, scientific or practical work) are conditioned upon (Djakons 2001):

- continuing fundamental education of the students of the specialty "Computer science" at the pedagogical university;
- implementation and usage of computer equipment (with appropriate software) practically in all the fields of human activity (in the process of secondary and high education; scientific, technical, economic and health care affairs);
- the fact that Computer Mathematics is one of the priorities area of research scientific work in informatics sphere as well as in physical-mathematical sciences.

One of the current high education problems is development of effective teaching system, its adaptation to Bologna process and implementation of Information and Communication Technologies (ICT), especially it concerns application of computer mathematics system (CMS) in the learning process. CMS application in the education system deprives students of making routine calculations and releases time for solution algorithms analyzing, problem statements, mathematical models constructing, and presenting results in the most convenient manner. The released time can be used for further learning of mathematical sense of problems and methods to solve them. This opens new opportunities for humanization of the learning process, humanization of education, and differentiation of studies according to the needs, attitudes and abilities of students. Using CSM can also improve students' skills in solving of mathematical problems. Despite their focus on strong mathematical calculations, CMS may be useful for lots of users such as students, teachers, engineers, PhD students, scientists, and even for pupils from mathematical classes of comprehensive and specialized school. CMS are widely applied in education system of advanced western countries. CMS using in domestic educational institutions demonstrates integration of our education system to the world system and points to the fact of increasing of fundamental informatics (informatics science, computer science) and mathematics education role (Kobylnyk (2008)).

The study of the course of "Computer Mathematics" shall show a place and importance of computer equipment not only for the educational process, but also for human professional development. This also should supply students with knowledge and skills in usage of computer equipment in the learning process, develop knowledge of purpose and classification of application software, functions and didactic opportunities for the distance learning systems in the learning process (Zhaldak 1997, Chechkin 1991).

**Educational** subject of course unit is consistent of components of Computer Mathematics methodological system at the pedagogical universities.

Interdisciplinary coordination is one of the important components of the training course. To comply with accessibility, consistency and science requirements, the study of "Computer Mathematics" is based on knowledge and skills got during studying of "Mathematical Analysis", "Algebra and Numbers Theory", "Informatics", and "Mathematical logic and Algorithms Theory". "Computer Mathematics" studying provides with the necessary knowledge to master "Methods of Informatics Learning", "Information systems and technologies in Economics".

Program of study for the variable-based course "Computer Mathematics" is prepared in accordance with educational and professional bachelor-level program of 0403 "System sciences and Cybernetics", specialty 6.040302 "Computer Science\*", and serves as basic document to define scope and orientated schedule of study of content packages according to high education industry standard.

Program of the course "Computer Mathematics" includes the following components (packages):

- 1. CMS and their usage in the learning process.
- 2. General informatics theory. Mathematical framework of computational geometry.
- 3. Fundamentals of coding theory and cryptology.

# **1. PURPOSE AND OBJECTIVES OF COURSE UNIT**

**Purpose** of "Computer Mathematics" is to develop students' knowledge and skills related to the theoretical basis of informatics which are needed for their further professional activities, generation of information, mathematics and general culture elements of pupils, intensification of cognitive activity, and providing training with research and creative characteristics.

There are the following **objectives** for achievement of the purpose:

- to define a place and importance of theoretical informatics basis for general and professional education; to explore psychological and pedagogical aspects of the course mastering, the relationship between the course "Computer Mathematics" and other courses (e.g. algebra, mathematical logic and algorithms theory, and school courses of informatics and mathematics); to show practical importance of knowledge of computer mathematics, applicability of the knowledge to solving a variety of humanitarian and technical problems of society.
- to assure fundamental learning of computer mathematics terms and methods which can be used in the learning process of certain parts of informatics, mathematics and elective courses in schools.
- to develop students' knowledge and skills needed for conducting of educational work in the process related to learning of different parts of school courses of informatics, mathematics, elective courses, and other forms of extracurricular school work with ICT using;

to instill in future teachers a creative approach to solving problems related to informatics and mathematics learning process (especially with ICT using); to give knowledge and skills needed for self dependent analysis of learning process; to develop ability and feeling of the need in continuous selfeducation and self-improvement, forming of informatics, mathematics and general pupils' culture, enhancing their individual cognitive and creative activity, providing training with research and creative characteristics.

The course is methodical and practical basis for all the skills and knowledge needed by the future specialist for performing of tasks related to the computer equipment usage (Graham et al. 1998).

**Students' knowledge.** The course "Computer Mathematics" is designed for the students, who have studied basic mathematics and informatics courses, got fundamental knowledge of PC work, Windows work and CMS usage.

As a result of the course studying, students shall get theoretical fundamentals of informatics needed for their professional improvement, consideration of computer mathematics in the mathematics and informatics education system, learning of computer mathematics elements within informatics and mathematics school courses.

**Students' skills.** As a result of the course studying students get and generalize necessary skills in solving of programming problems with using CMS that can assure forming of the following competences:

- social and individual;
- general scientific;
- instrumental;
- professional.

The course "Computer Mathematics" (according to the study plan of bachelors or masters) belongs to the variable-based part of scientific, professional and practical studying. 3.5 credits or 126 teaching periods are necessary for the course in general; 46 teaching periods are for individual (self-dependent) scientific and educational student work, and 80 teaching periods are for class hours (36 teaching periods for lectures and 36 for laboratory works). Individual work consists of preparing for the class hours, performance of tasks proposed within laboratory works, and preparing for module (package) control etc.

Teaching of the training course is provided by usage of scientific and technical literary sources (list of the sources is supplemented to the laboratory works instructions), technical equipment, and necessary software.

The lecture course determines the purpose and objectives of "Computer mathematics", its main terms and methods, theoretical and practical importance of the course. Besides that, lectures content shall be in consistency with previously learned data on informatics, algebra, elementary mathematics, and show relations

with materials of informatics and mathematics school courses. Performing and submitting of laboratory works shall be within laboratory classes.

Problem issues (theoretical and practical) arisen within the course shall be discussed during student consultations.

Self-dependent (individual) and distance consists of preparing to class hours, performing of tasks proposed within lectures and laboratory works, analyzing specialized literature for considering individual homework issues. This is possible due to the developed distance course "Computer Mathematics" on the basis of Moodle (module dynamic object-oriented environment for the learning process). Distance learning system Moodle is available free system of training sources management; the system is focused on the organization of student-teacher cooperation. Moodle environment is developed by using PHP programming language with the usage of SQL-base; the environment is of module architecture that allows functions branching. Also Moodle has considered safety system; administrator functions allow adjusting appearance and functionality of the system (i.e. switch on and switch off embedded modules). This makes possible for the teacher to control access to the course, use time limits, create own knowledge evaluation system, control students' delay in tasks performing, and arrive a decision concerning repeating of a test etc. Any electronic document (useful in the course development with using e-learning) can be shown via the distance learning system Moodle. Chats and forums shall be conducted for organization of cooperation between the learning process participants. Performance test is realized in the system due to the separate module which consists of different types of tests. Possibility of repeating of tests depends on the teacher permit. Plagiarize ban is possible with the help of issue randomization (Smyrnova-Trybulska 2007).

Students get their points (grades) due to the performing of laboratory works, additional individual tasks, solving of strong problems, preparing of scientific reports, and presenting of new software programs.

The important objective of the course "Computer Mathematics" is to instill in future teachers a creative approach to solving op problems related to informatics and mathematics learning process. ICT using allows to intense educational activity, add more issues for learning.

### 2. INFORMATION SCOPE OF THE COURSE

The content of the course "Computer Mathematics" consists of three modules (packages). The list of the main terms (for each module) that students should *know* and the main *skills* that they should get, and subjects (topics) for learning are provided below.

#### Module I. Mathematical foundations of computer science

**Main terms.** Mathematical model, CMS, Maple system command, Maple system package, CMS Mathematica, Derive, Maxima, Matlab, Mathcad.

**Main skills.** To solve problems related to the informatics and mathematics with using Maple, Mathematica, Derive, Maxima, Matlab, Mathcad.

#### Subject 1. Mathematical modelling.

Concept of mathematical model. Mathematical modeling method for solving application issues of mathematics, physics, biology and other sciences.

#### Subject 2. CMS and their using in the learning process.

Problem solving stages by the way of PC. Review of the main CMS. Syntax and the principal commands of Maple system. Analysis of the main packages of Maple system. Significant opportunities for using Mathematica system in comparison with Maple system. General characteristics of other CMS: Derive, Maxima, Matlab, Mathcad.

# *Module II.* Foundations of the information theory. Mathematical foundations of computational geometry

**Main terms.** Amount of information, information additivity, coding of information. Computational geometry, point, intercept, vector, line, subspace, point location, polygon, convex polygon,

**Main skills.** To determine amount of information, to sole problems related to fundamentals of coding of information. To define distance between points, to form equation of line, to solve problems on computer graphics (related to the relative position of points and figures), to check polygon convexity, to define belonging of the point to internal part of the polygon, to calculate the polygon area.

# Subject 1. Foundations of the information theory. Hartley formula and Shannon's equation for determination of amount of information.

Introduction to the information theory. Main tasks of the information theory. Hartley formula (and its application) to determine amount of information. Information additivity law. Alphabetic approach to determine amount of information. Information and probability. Shannon's equation. Optimum coding of information. Hoffman's prefix code.

# Subject 2. Mathematical foundations of computational geometry and computer graphics. Task of computer graphics concerning relative position of points and figures.

Coordinates and vectors in the subspace. Different methods to make equation of line. Computer graphics tasks concerning relative position of points and figures. Polygons. Convex polygons.

#### Module III. Fundamentals of coding theory and cryptology

Main terms. Prime number, Euclid's algorithm, Euler function, congruence, RSA.

**Main skills.** To put a number in the canonical form, to determine the greatest common divisor (GCD) for two whole numbers, to calculate Euler function, to solve congruence, to code and decode information according to RSA system.

#### Subject 1. Divisibility of numbers. Foundations of the congruence theory.

Euclid's algorithm for determination of GCD for two whole numbers. Euler function. Congruence and its properties.

#### Subject 2. Fundamentals of coding theory and cryptology. Pattern discernment.

Introduction to the coding theory. Elementary cryptography (mathematical approach). Public-key cryptosystem. RSA system. Digital signature. Pattern discernment.

#### CONCLUSION

Examination is a type of final control of students' achievements after the course studying. Students can accumulate certain amount of points due to the work within laboratory classes, performance of individual homework tasks, preparation of scientific reports, and module tests. According to this, evaluation of students' achievements is performed.

Program structure (according to the block-modular scheme) is targeted to the maximum level of the learning process individualization. Program structure is made in the way to provide students with opportunities for studying in individual pace and focusing on certain requirements concerning learning of training materials.

Monitoring of students' learning (performance rating) is performed due to the module-rating system. Educational activity of students is evaluated in accordance with 100-point system.

#### REFERENCES

- Aladjev, V.Z., 2006: *Computer Algebra Systems: Maple: Programming art.* Laboratory of Basic Knowledge, Moscow, 2006, pp.792. [In Ukrainian]
- Chechkin, A.V., 1991: *Mathematical Informatics*. Science, Moscow, 1991, pp. 412. [In Russian]
- Djakons, V.P., 2001: Computer Mathematics. Theory and Practice. Knowledge, Moscow, 2001, pp. 1296. [In Russian]
- Graham, R., Knuth, D., & Patashnik, O., 1998: Concrete Mathematics. The bases of computer science. World, Moscow, 1998, pp. 703. [In Russian]
- Kobylnyk ,T.P., 2008: Systems of Computer Mathematics: Maple, Mathematica, Maxima. Circle, Drogobych, 2008, pp. 338. [In Ukrainian]

- Kondrashov, V.Y., & Korolev, S.B., 2002: MATLAB as a system of scientific and technical calculations programming on the scientific and technical calculations. World, Moscow, 2002,- pp. 350. [In Russian]
- Kuzmin, A.N., Kuzmina, N.M., & Rystsov, I.K., 2006: Symbolic computation in Maple system: Ed. book. IAPM, Kyiv, 2006, pp. 108. [In Ukrainian]
- Mao, V., 2005: *Modern Cryptography: Theory and Practice*. Williams, Moscow, 2005, pp. 768. [In Russian]
- Preparata, F., Shejmos, M., 1989: Computational Geometry. World, Moscow, 1989, pp. 479. [In Russian]
- Ramsky, Y.S., 2003: Logical Foundations of Computer Science. Dragomanov National Pedagogical University, Kyiv, 2003, pp. 286. [In Ukrainian]
- Smyrnova-Trybulska, E.N., 2007: Fundamentals of generating information competences of teachers in the field of distance learning. Monography. Ailant, Kherson, 2007, pp. 704. [In Russian]
- Soloviev, F.I., 2005: *Introduction to Coding Theory*. Novosibirsk State University, Novosibirsk, 2005, pp. 130. [In Russian]
- Verbitskyi, O.V., 1998: *Introduction to cryptology*. Publishing House of Scientific and Technical Literature, Lviv, 1998, pp. 248. [In Ukrainian]
- Zhaldak, M.I., 1997: Computer at the mathematics lessons. Technology, Kyiv, 1997, pp. 304. [In Ukrainian]

# E-LEARNING IN EDUCATION OF PEOPLE FROM IT DEPARTMENT

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**Abstract:** In the last years there has been a fast development of the Internet technologies, which was followed by the possibility of using them almost in every field of life. One of these fields is distant learning which is also called e-learning. Day after day it is becoming more and more popular and many schools use teaching platforms as the alternative solutions to the traditional teaching. This kind of learning is the chance for working people, who have to connect daily duties with the job. This paper is a description of the e-learning methods of people education, who are working or want to work in IT industry.

Keywords: e-learning, Life Long Learning, IT industry, Information Society

#### **INTRODUCTION**

The changes which are now taking place in higher education are due to the development and the use of modern tools and information and telecommunication technologies. One of the most important elements introduced to the teaching process is e-learning. Its unquestionable merits make this form of education more interesting. Further academic centres introduce classes using e-learning methods to their offer. These are both blended learning and fully e-learning classes. Also among the students the distant learning method is gaining more and more supporters, especially among workers who are forced to reconcile the daily duties with the education and among the disabled people who, due to their health problems, are unable to attend classes but for whom obtaining education is a necessity or opportunity for a better job.

Moreover, introducing the techniques of distant learning to classes is becoming a more and more important criterion for assessing the department, or even the whole university. Also, the times in which we live - the era of the information society – require us to learn lifelong.

# 1. LIFE LONG LEARNING

Life long learning (LLL) in a document issued by the European Commission in 2000 was described as "all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competencies within a personal, civic, social and/or employment-related perspective" (Memorandum, 2000). According to this definition, lifelong learning is not restricted only to the education of adults (Sysło 2009). In order to provide the graduates of the universities with the knowledge and skills needed for their professional lives, the basic studies (meaning the studies from the first till the last year, finished with graduation and diploma) and later education need to be treated as one coherent process of education. This raises the need to split all the necessary knowledge into two parts. The first is the one that is delivered during the basic studies, and the second is that which is provided when needed (Mischke 2008).

In order to pursue lifelong learning, a database of finished courses should be set up which could be mobilized in case of need. The introduction of e-learning options afforded such an opportunity to prepare short courses serving a single issue that, if there was the need can be combined into a larger one. Traditional education does not make that possible. Material provided in textbooks or scripts is selected to fill the learning period measured in semesters and to prepare graduates for a variety of professional career circumstances (Mischke 2008).

The development of information and communication technology has made life-long learning take on a new dimension. First of all, the mere possibility of lifelong learning has been strongly expanded. Also, the continuous development of technology forces us to continuously develop our skills and improve our competences in using it (Sysło 2009).

As a result of intensive development and dissemination of information technologies there is the emergence of a new socio-economic formation, the so-called information society. Its creation entails far-reaching effects. The person who has to function in that society must have a special relationship with information technology, as it is used in almost every area of their life. (Tadeusiewicz 2008). It is therefore necessary to continue the education and training of people working in the computer science industry.

### 2. DISTANCE EDUCATION IN POLAND ON THE EXAMPLE OF THE DISTANCE – LEARNING CENTRE – OKNO PW

The natural response to the growing demand for remote education has become the creation of centers offering the opportunity of such education. Many of them are located in the United States, and it is probably related to long distances between cities and citizens in this country. Therefore it can be concluded that the universities in this country have the greatest experience in carrying out this type of training (Rokicki 2013).

Browsing the resources on the Internet one can find many universities throughout the world involved in distance learning. These are both high schools with rich traditions, as well as smaller colleges that their existence is based on the activity in the Internet.

Polish response to the needs of higher education for online education was the creation in 2000 by the Warsaw University of Technology non-faculty organizational unit called the Centre for Distance Education (abbreviated OKNO PW), primary task of which was to develop and implement the practice of studying via the Internet. The original model of this type of studying is called the SPRINT model, and the model for the study was the distance learning type run by the Open University in the UK and in German FernUniversität (Studia 2013).

Currently the objective of the Centre is to carry out organizational, information and coordination activities in the area of continuing education and distance learning, using the Internet and multimedia technologies. Moreover, the aim of the OKNO PW is to support and promote the development of new technologies and forms of education based on the use of the latest teleinformative technologies and the Internet as well as the coordination of international cooperation of Warsaw University of Technology in this area (Kula 2012).

On-line studies coordinated by OKNO PW began on 17 September 2001. They were extramural engineering studies at the three faculties: Electronics and Information Technology, Electrical Engineering and Mechatronics.

Currently on the offer of distance studies are the following directions:

- 1. Part-time four-year engineering degree (first stage BS), conducted in the academic year 2001/02 by three departments in three directions:
- Information Technology at the Department of Electrical Engineering,

- Electronics and Telecommunications at the Department of Electronics and Information Technology, Automation and Robotics at the Department of Mechatronics. Studies are divided into three stages: Basic Studies (1 year), Directional Studies (2 years), Specialised Studies (1 year).

- 2. Part-time two-year Master's degree (second stage), conducted in the academic year 2005/06 by the Departments of Computer Science: Electronics and Information Technology and Electrical Engineering, with the participation of officials from other Departments of the University.
- 3. Postgraduate two-and three-semester studies:

a. Computer and Internet Technology conducted at the Department of Electrical Engineering,

b. Tools and Techniques of virtual education conducted at the Department of Electronics and Information Technology (Masters 2013).

In the academic year 2011/2012 a group of students in OKNO PW had 1131 people, including 32 people from outside Polish borders. More than half of them (623 people) came from Mazowieckie. The fewest of students came from the provinces of of Lubuskie (3 persons) and Opole (5). The most popular among the students were the specialties: *Computer Engineering and Applied Computer Science*, and the least - *Systems of Decision and Management Support* (Kula, 2012).

The offer of the center OKNO PW shows that people working or wishing to work in the IT industry can find something for themselves. It may be said here that it was an attempt to create materials for the information society.

#### 3. BEST PRACTICES RELATED TO ACADEMIC E-LEARNING IN THE STATE HIGHER VOCATIONAL SCHOOL IN KROSNO

Due to a rapidly growing market of e-learning newer curriculum and e-learning platforms are constantly being introduced, both free and commercial, enabling the preparation of courses for which the latest techniques and tools have been used. As can be seen even from the offer presented in the previous section, also studies are run that are designed to prepare specialists in a particular field.

Every year there are more and more universities offering online education. Most of them choose the method of blended learning, i.e. the classes carried out in the traditional way are enriched and supplemented by on-line activities.

Among the universities that run part of their courses with the use of modern educational tools is the State Higher Vocational School name Stanisław Pigoń in Krosno. In 2003, the authors began conducting classes enriched with elements of online material as first in the institution. At first they were only some materials from lectures for students placed on the website. With time came the tasks and interactive examples, and eventually the idea of creating an educational portal, which has been called an e-Student. Its main goal was the possibility of supporting traditional education by on-line education. This site used the Moodle platform. (Dębska 2008).

The first subject, to which the authors have developed materials were *Algorithms and Data Structures*, carried out on semester 2 of the year 1 of studies in Computer Science. Fig.1. shows the list of subjects which were available for students through the e-Student platform.

Gradually, other departments of the Krosno Higher Vocational School started introducing e-learning classes to their offer. To make it possible, the project of training teachers in Internet technologies and e-learning methods was prepared.



# Figure1. The list of subjects taught by blended-learning method for the students of Computer Science

#### Source: Own

In 2009-2012 there were 3 editions of two-semester course for the teaching staff of the State Higher Vocational School in Krosno in modern methods of education, within the project "The course on the economy! – The development of the State Higher Vocational School in Krosno". Its purpose was to prepare the teaching staff to develop their own independent online lessons. The result was the emergence of new courses developed by the personnel for subjects taught in their fields. Figure 2 shows the image of the course selection on the e-student platform with a course demonstration and Help developed as an aid for teachers and self-study materials prepared for the different fields of study.

Since its launch, the portal e-student continuously evaluates. With time, it has become an interactive and personalized portal, using artificial intelligence methods to generate individual training paths, thus gaining adaptive traits. By collecting data on the test results, the time spent on the site and the previous classification results, the individual changing path of education is selected for the student. Since for classification five characteristic features are taken into account, it can be concluded that the chosen educational path is appropriate for the student. It can be said that the portal gives students the opportunity to use the learning process tailored to their needs. The possibility of changing the education path to a higher one supports the student's intrinsic motivation to work. Moreover, the path of education evaluates with the change in the student's knowledge level, which is undoubtedly the greatest advantage of the e-Student (Dębska 2009).



Figure 2. The image of the e-Student platform.

#### Source: Own

Student reviews of the portal, expressed by them in the classroom and through surveys are very positive. They claim that the materials provided in this way are very helpful for them during the semester as well as during the preparation for credit tests and examinations. They are of great assistance in the learning process.

### CONCLUSION

Today, almost every university has in its offer at least some courses taught using elearning method, if not whole classes. This form of training is gaining more and more groups of followers. Certainly, this is a rapidly growing field, whose task will be to prepare graduates for jobs and roles that they will play in the information society. To create courses the ability to use IT tools is required, also, the functioning in the information society requires the fluency in using them. Therefore, it will be one of the most important and most necessary human skills (Tadeusiewicz 2008). Well qualified professionals who will be able to handle the necessary equipment and tools changing and developing practically day-to-day will be needed. Hence the continued and growing interest in the field of the computer science.

#### REFERENCES

- Dębska B., Kubacka A., 2008, Improving the quality of distance education through personalized educational portal, In: Advances in e-learning, Publishing House of Warsaw University of Technology, Warszawa, pp. 291 – 300, ISBN 978-83-7207-795-0. [In Polish]
- Dębska B., Kubacka A., 2009, Adapting educational portal of educational content to the changing perception capabilities of students, In: Advances in elearning, Publisher PJIIT, Warszawa, pp. 227-235, ISBN 978-83-89244-82-6. [In Polish]
- Internet Studies at Warsaw University of Technology OKNO, available at http://www.okno.pw.edu.pl/index.php?page=other&subpage= studia (accessed 07.2013). [In Polish]
- Kula I., Plebańska M., 2012, Promotion of university e-learning the experience of the Centre for Distance Education University of Warsaw, Ementor nr 3 (45)/2012, p. 64-70. ISSN 1731-6758. [In Polish]
- Memorandum Komisji Europejskiej dotyczące uczenia się przez całe życie, 2000 [Memorandum on Lifelong Learning, Commission of the European Communities, Brussels, 2000].
- Mischke Jerzy M., 2008, *E-learning as a tool for the modernization of higher education?*, in: Progress e-learning, Publishing House of Warsaw University of Technology, Warszawa, pp. 105-115, ISBN 978-83-7207-795-0. [In Polish]
- Rokicki B., Świętochowski P., Romaniuk R., Poźniak K., Education via the Internet as a modern form of Distance Education on the example of OKNO.PW, available at http://www.ise.pw.edu.pl/~rrom/papers/okno.pdf (accessed 07.2013). [In Polish]
- Sysło M. M., 2009: *E-learning in school*. E-mentor nr 1 (28) / 2009, pp. 23-31. ISSN 1731-6758. [In Polish]
- Tadeusiewicz R., 2008: The development of information technology as a factor in determining the progress of civilization, In: Advances in e-education, Publishing House of Warsaw University of Technology, Warszawa, pp. 243-259, ISBN 978-83-7207-795-0. [In Polish]

# THE USING OF MOBILE APPLICATIONS IN E-LEARNING

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**Abstract:** The article is devoted to the problems of using mobile applications in *e-learning*. The basic requirements for modern mobile applications that is designing for education. Describes the features of the mobile application "Chemistry".

Keywords: e-learning, educational process, mobile device, mobile application

#### **INTRODUCTION**

Modern information and communication technologies take part in educational process everywhere. So-called e-learning captures the minds of all participants of learning process. Nowadays all the tests, term papers and dissertations are done by computers, but before they were written by hand. Automated test systems are being used for testing knowledge. Electronic digital devices are being used for modeling different scenarios and all sorts of measurements. Different information and communications services and systems are being used for interaction between the participants of educational process

To date, one of the fastest growing areas in the industry of information technologies is the mobile industry (http://canalys.com/newsroom/smart-mobile-deviceshipments-exceed-300-million-q1-2013; http://www.gartner.com/newsroom /id/2525515). According to a retrospective analysis of the global market for mobile applications, the average annual growth of the market is 293%. After 2012, the global market for mobile applications has reached 8 billion dollars in cash (http://www.json.ru/files/reports/2013-08-07\_Mobile\_Development\_MW\_RU. pdf). Today everyone can download and install and configure the tools for developing mobile applications to further their coding for the selected operating system, then deploy your project in the specialized markets.

Big industry has emerged in the world of developers, whose interests are mobile applications. They affect all spheres of human activity, from games and applications for online store, to big training and educational systems. Mobile applications are very popular because they are functually rich and have got great technical capacities. They possess a high degree of mobility in the modern world. It is appreciated very highly.

Mobile information technology is penetrating in education.

## **1. INCLUDING MOBILE DEVICES IN LEARNING**

Many educational institutions around the world are actively implementing and using mobile devices and applications in their lessons.

Example, in schools of the United States tablets are replacing PCs. According to Apple Insider referring to a note to investors, analyst Charlie Wolf of Needham & Company shipment of personal computers in educational institutions of the United States declined by 265 thousand pieces or 13.9% in percentage terms for the last year. At the same time, Apple sold nearly 1 million iPads in the segment of secondary education in June 2013 (http://www.cnews.ru/top/2012/09/06/v\_shkolah \_ssha\_ipad\_vytesnyaet\_pk\_v\_rossiyskih\_pochti\_ne\_ispolzuetsya\_502027).

Another example is that the Education Minister of France Vincent Peillon initiated the "digital era" in schools and proposed to use tablets in learning. "Tablets have significant motivational impact on the generations that were born when modern technologies arise. It was found that attention is kept much longer when using the iPad. This raises the question of visualization. Using devices with touch sensors offers many advantages including allowing the child to active take a part in learning. The ability to manipulate information makes it easier to assimilate. As in video games, a rare learning logic from own mistakes appears. It is easier to make mistakes. Losing streak in video games teaches us to win. Thus, this reinforces the desire to move forward" said child psychologist of the clinical hospital center of Pantene, Michael Stora (http://www.atlantico.fr/decryptage/peut-on-se-fier-cette-etude-qui-montre-que-tablettes-permettraient-aux-enfants-mieux-reussir-ecole-michael-stora-philippe-cottie-753805.html).

Many Russian educational institutions try to keep up with the world trends and also introducing mobile gadgets in educational process. So the experiment on introduction of e-books in secondary education ended in Russia (http://www.rb.ru/article/v-rossii-zavershilsya-eksperiment-po-vnedreniyu-elektronnyh-uchebnikov-v-sredney-shkole/7044167.html). The experiment was very

successful and the participants left a lot of positive feedback.

# 2. KEY REQUIREMENTS OF EDUCATIONAL MOBILE APPLICATION

If you take a closer look at using mobile devices, it can see that schools and universities are using mostly tablets and e-books and use them only as a means of content consumption. In other words, students learn only consume information, but do not create it. This can lead to further oppression of creative and artistic abilities. The current using of mobile devices in educational process is missing the element of testing knowledge. It is also required when getting new knowledge. It follows from the above that this approach is ineffective.

The way out of this situation is redefining emphasis when using mobile devices. Instead of mobile gadget like a container for educational content, center of attention must be educational mobile applications with rich functionality that will enhance the effectiveness of the educational process. However, not every mobile application can be used as educational. It must meet a number of key requirements:

1. *Consistency and continuity.* All information should be providing sequentially, as if it was presenting in the course of the discipline. The information providing in each new section should base on the information in the previous section.

2. *Structure and conciseness*. All information of the subject area that is used by the application must be present in a structured and concise form. The user of the application must be aware of where he is, and he should not be confused with present information.

3. *Visibility and informational value*. The data, which used the application, should be concise and informative. It must be easily understood and remembered.

4. *The control of knowledge*. The application must have the functions of control of knowledge, because it is an integral part of the educational process.

You can also select several additional requirements to educational mobile applications. You can pay no attention to them, but they maybe taken into account in the development of educational mobile apps:

5. *Interactivity*. The application must allow the user to make different decisions in the course of its use and interact with it. This allows you to keep a child's attention for long periods and make an element of creativity.

6. *Communications*. The application must allow sharing results. For example, the exchange of test results between children and their parents through e-mail.

# 3. EDUCATIONAL MOBILE APPLICATION "CHEMISTRY"

A good example of educational mobile application is the mobile application "Chemistry", developed by the Russian State Vocational-Pedagogical University. The application is dedicated to the study of the science of chemistry. This science is difficult enough when you study at school and University.

The application "Chemistry" is a mobile application. It does not use internet connection and it includes all information.

Information in the application is to encourage the user to explore and interact with it directly, rather than through special buttons. Important information is presented immediately, secondary and detail information goes to the background, but is available in one action.

The application is developed for the version of the mobile operating system Windows Phone 7.1 and above. The application is constantly being updated and improved. Developers are adding new functions and features.

The application "Chemistry" is divided into 5 major programming blocks: "Elements", "Substances", "Tables", "Reactions" and "Control".

The block "Elements" provides a convenient interactive form with all known chemical elements (Figures 1, 2). All items are presented as tiles. Each tile displays basic information about chemical element: number, designation, name, radiation if it is radioactive. If a user chooses any element he navigates to a page that contains all the known properties and detailed description with the image of the element. All elements in the block are divided into groups according to the classification of the chemical elements in the periodic system D.I. Mendeleev.



Figure 1. Page "Elements"

Source: http://www.windowsphone.com/ruru/store/app/xumus/6fce68c2-f961-47c2-94bd-59b53adbaba7



Figure 2. Page of element "Hydrogen"

#### Source: Application "Chemistry". Own elaboration

The block "Substances" contains many different substances studied as part of school disciplines (Figures 3, 4). All substances in this block are divided into groups according to the classification of inorganic chemistry. In addition, substances within groups are divided into subgroups. This block is implemented an interactive search to easily find the necessary substance within it. Each substance appears in two rows for ease of retrieval and perceptual information. The first (large) line contains the formula. The second line contains the name. When the user is choosing the substance, he navigates to the page with the detailed description about it. This page contains name, group, subgroup, formula and detailed description.

Blocks "Elements" and "Substances" also include a large number of 3d models of chemical elements and compounds (Figure 5). All 3d models are interactive. They can be rotated in different directions and scale using multitouch.



Source: Application "Chemistry". Own elaboration

Source: Application "Chemistry". Own elaboration



#### Figure 5. 3d-model of substance "Calcium oxide"

Source: Application "Chemistry". Own elaboration

The block "Tables" includes the periodic system of chemical elements and table of solubility of salts and acids and bases (Figures 6, 7). All tables in this block are interactive. You can access information about element or substance.
N	иенделеева	РАСТВОР	имости																
1	'H	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	<sup>2</sup> He	1
2	водород З Ді	4 Ве бериалий											5 <b>B</b> 600	6 С	7 <b>N</b> 8307	в	9 <b>F</b> 000	<sup>10</sup> Ne	z
3	11 <b>Na</b> натрий	12 Мд матний											<sup>13</sup> АІ алюминий	<sup>14</sup> <b>Si</b> кремний	<sup>15</sup> Р фосфор	16 S cepa	17 СІ хлор	<sup>18</sup> Аг аргон	3
4	<sup>19</sup> К калий	20 Са кальций	21 <b>Sc</b> скандий	22 <b>Ті</b> титан	23 <b>V</b> ванадий	Cr xpom	25 Мп марганец	<sup>26</sup> <b>Fe</b> железо	27 Со кобальт	28 <b>Ni</b> никель	<sup>29</sup> Си медь	Zn	31 <b>Ga</b> галлий	<sup>32</sup> Ge германий	аз As мышьяк	<sup>34</sup> Se	<sup>35</sup> Br бром	<sup>36</sup> Кг криптон	4
5	<sup>37</sup> <b>Rb</b> рубидий	<sup>зв</sup> Sr стронций	<sup>39</sup> <b>Ү</b> иттрий	40 <b>Zr</b> цирконий	41 <b>Nb</b> ниобий	42 Молибден	43 Тс технеций	44 <b>Ru</b> рутений	<sup>45</sup> <b>Rh</b> родий	<sup>46</sup> Р <b>d</b> палладий		<sup>48</sup> Сd кадмий	<sup>49</sup> In индий	50 Sn 0.0080	Sb сурьма	52 Теллур	53   Йод	54 Хе ксенон	5
6	<sup>55</sup> Сs цезий	<sup>56</sup> Ва <sub>барий</sub>	57-71	72 <b>Нf</b> гафний	73 <b>Та</b> тантал	74 <b>W</b> вольфрам	75 <b>Re</b> рений	76 Осмий	77 Ir иридий	78 Рt платина	79 Ац золотс	во Нд	81 <b>ТІ</b> таллий	<sup>82</sup> Рb	висмут	84 А Ро полоний	actat	Rn pagon	6
7	87 & Fr франций	<sup>88</sup> А Ra	89-103	<sup>104</sup> <b>Rf</b> pe3epφop	105 A	106 Sg сибортий	<sup>107</sup> Вh борий	108 🐣 Нѕ	109 🛕 Мt мейтнериі			112 A							7
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
				57 La	58 Се	59 Рг празеодил	<sup>60</sup> Nd неодим	61 А Рт	<sup>62</sup> <b>Sm</b> самарий	б3 Ец европий	<sup>64</sup> Gd гадолиний	<sup>65</sup> ТЬ тербий	66 <b>Ду</b> диспрозий	67 Но гольмий	<sup>68</sup> Ег эрбий	<sup>69</sup> <b>Тт</b>	70 <b>Үb</b> иттербий	71 Lu лютеций	
				89 🐣 Ас актиний	<sup>90</sup> <b>Th</b>	91 🐣 Ра	92 🐣 U уран	93 🐣 Nр нептулий	94 🐣 Ри	95 🐣 Ат америций	96 🐣 Ст	<sup>97</sup> <b>ВК</b> берклий	98 Сf	99 🐣 Es эйнштейны	100 🐣 <b>Fm</b> фермий	101 A	102 🐣 <b>No</b> нобелий	103 🔺 Lr лоуренсий	

#### Figure 6. Mendeleev's table

Source: Application "Chemistry". Own elaboration



#### Figure 7. Table of solubility

Source: Application "Chemistry". Own elaboration

The block "Reactions" allows for a variety of reactions between chemical elements and substances and presents the results of reactions in a convenient interactive form

(Figures 8, 9). In any reaction user allows to select from one substance to two substances. After the reaction, by clicking on the appropriate button, the application switches to the page with the reaction result. This page contains reaction formula.

реакции СОЕДИНЕНИЕ	разложение	обмен	замещение
первое вещество азот	вещество гидроксид железа (II)	первое вещество азотная кислота	первое вещество алюминий
второе вещество кислород	разложить	второе вещество оксид меди	второе вещество соляная кислота
соединить		обменять	заместить

#### Figure 8. Page "Reactions"

Source: Application "Chemistry". Own elaboration



Figure 9. Page of reaction result

Source: Application "Chemistry". Own elaboration

These blocks are reference material. It can be used in the educational process for study the elements and their structures and for study the periodic table and for study substances inorganic chemistry and for study the table of solubility of substances and for study the basics of reaction formulas. All the information in them is very good to remember and learn. The main tool in testing knowledge is the block "Control" (Figures 10, 11). It provides various kinds of tasks in a test form from the name of an element, to insert the missing substance in the reaction formula. Each type of test contains ten questions. It randomly generates when loading of a test. After passing, the test counts the time and the percentage of correct answers. You can study errors made during the test for more learning. Many of the items are in colors for better understanding and memorizing. The list of tests is constantly update.

контроль 12345678	контроль результат 80%
название элемента по обозначению Обозначание	<sup>время</sup> 00:01:12.3730000
ОТВЕТ	1. С - углерод верно 2. Pd - палладий
	верно 3. Np - нептуний
	верно 4. Не - гелий
	5. Sm - соммий неверно самарий
···· (	6. Br - бром верно

Figure 10. Page of test "Name of an element"

Source: Application "Chemistry". Own elaboration

Figure 11. Page of test result

Source: Application "Chemistry". Own elaboration

Taking into account the foregoing, the application is fully consistent with the key requirements.

To date, the application "Chemistry" downloaded over 45 thousand users. Rating is 4.5 out of possible 5 points. Users left about 270 ratings and reviews from Belarus, Great Britain, Latvia, Russia, Ukraine and United States of America. Many users really help track errors that relate to the subject area when they left feedbacks, because a very large amount of information. All users agree that the educational mobile application "Chemistry" is awesome. They are even willing to pay for it.

In general, the application "Chemistry" is designed in such a way that it can be used as a reference platform for developing educational mobile applications for other substantive and scientific areas.

# CONCLUSION

To sum up, educational mobile applications have a great future. In connection with the spread of education and its orientation towards the use of new technologies and means of education educational mobile applications will be very good assistants when studying a variety of scientific areas. Technology that helps to develop mobile applications allows you to make the process of learning more interesting and interactive. It is the most important thing. Of course, this advantage will affect the quality of learning.

# REFERENCES

- Atlantico: Can we rely on study, which shows that tablets would enable children to better succeed in school? [In French] available at http://www.atlantico.fr/decryptage/peut-on-se-fier-cette-etude-qui-montre-que-tablettes-permettraient-aux-enfants-mieux-reussir-ecole-michael-stora-philippe-cottie-753805.html, (accessed on 13 September 2013)
- Canalys: *Smart mobile device shipments exceed 300 million in Q1 2013*, available at http://canalys.com/newsroom/smart-mobile-deviceshipments-exceed-300-million-q1-2013, (accessed on 13 September 2013)
- CNews: *iPad is more popular than PC in the USA while it is almost not used in Russia*, available at http://www.cnews.ru/top/2012/09/06 /v\_shkolah\_ssha\_ipad\_vytesnyaet\_pk\_v\_rossiyskih\_\_pochti\_ne\_ispolz uetsya\_502027, (accessed on 13 September 2013) [In Russian]
- Garther, *Traditional PC Shipments to Decline 10.6 Percent in 2013, While Tablet Shipments Increase 67.9 Percent,* available at http://www.gartner.com/newsroom/id/2525515, (accessed on 13 September 2013)
- J'son & Partners: *Market Watch "Market for mobile application development*" [In Russian], available at http://www.json.ru/files /reports/2013-08-07\_Mobile\_Development\_MW\_RU.pdf, (accessed on 13 September 2013)
- RB.ru: *The experiment on introduction of e-book in high school ended in Russia* [In Russian], available at http://www.rb.ru/article/v-rossiizavershilsya-eksperiment-po-vnedreniyu-elektronnyh-uchebnikov-vsredney-shkole/7044167.html, (accessed on 13 September 2013)

# V. E-LEARNING IN THE DEVELOPMENT OF THE KEY COMPETENCES. METHODS, FORMS AND TECHNIQUES IN DISTANCE LEARNING. M-LEARNING

# ELECTRONIC QUESTIONS WITH THE INCREASED VALUE FOR FEEDBACK

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Abstract: The paper deals with the possibility of the electronic questions improving with the goal to support the useful feedback for the teachers and subject guarantors. The proposal of enriching of the 'multiple choice multiple correct' electronic questions is described and the practical example is given. The described approach can be widely used especially in the current distance learning. The author assumes that there is also a chance for not only gifted students' motivation support. The author offers the described approach for discussion. The text is a result of the author's current vision in this field.

Keywords: electronic question, test, feedback, ICT, motivation

#### **INTRODUCTION**

A necessary tool for the successful teaching and learning processes is a suitable feedback. The development of information and communication technologies (ICT) and the exploration of new creative forms of their usage in education can also bring the positive effects in the field of students' knowledge assessment. The high-quality feedback should serve both the subject improvement and also required study results acquiring.

A very important role in this field can be played by the electronic self tests (Hrubý 2009) and the electronic tests. The main difference between them should be the rule that electronic self tests should serve only for students and so their monitoring should be enabled only on a global level without the identification of a concrete

student's results. On the other hand, the electronic tests should serve for the teachers' needs, especially for the continuous assessment during the semester, the granting credits and passing the subject exams. The electronic testing can help to evaluate students' work fairly and effectively. The same conditions can be ensured for all tested students.

The author assumes that the most useful type of electronic questions are the questions of the 'multiple choice – multiple correct' type. The goal of the next text is to give a formal description of so called 'extended elements of the question objects' and to suggest their possible use in education. The author's point of view is based on his experience from ICT focused university department and the teaching of information technology (IT) oriented subjects, such as 'Computer programming'.

## **1. TWO BASIC TERMS**

In (Hrubý 2011) the terms 'Question Object' and 'Electronic Question' were defined. Generally, each Question object is an object which can generate the electronic questions. Because of the definitions of these both terms form the starting point for this article, these are stated below.

#### 1.1 Question Object

Question object  $(Q_0)$  is a structure

 $Q_0 = [id, qf, ans, sco, fdb]$ 

where

*id* is the name of the question object type template;

*qf* is the question formulation;

ans are answers;

sco is scoring;

*fdb* are feedback conditions (feedback can be immediate and delayed).

Answers (ans) can be a small database that consists of various possible answers which differ in number of points that a tested person (student) can receive. Scoring (sco) can use positive and also negative points connected to every possible answer that is defined. Good scoring setting is often a very sensitive and difficult task. Feedback (fdb) is designed and sent to the tested person.

#### **1.2 Electronic Question**

Electronic question (Q) is a structure

$$Q = [Q_0, as]$$

where

- $Q_o$  is a question object;
- as is the list of answers which were generated from  $Q_0$ .

It is a necessity to say that 'as' is a subset of 'ans' from the previous definition of the Question object.

The author assumes that the Question objects could have additional 'extended elements of the question objects'. Their proposal is introduced in the next part of the article. The concrete example of their realization will also be presented.

# 2. EXTENDED ELEMENTS

#### 2.1 The Purpose of the Extended Elements

The purpose of the 'extended elements of the question objects' is to give the possibility for the realization of a higher-quality feedback. The description of 'extended elements' is a result of the author's research which was based on the description of the 'Question object' structure published in (Hrubý 2011). The formal description of the Question object structure was the first step of the research which has led to the proposal of 'extended elements' – the new results of the author's research.

The added value of 'extended elements' resides in new useful information about the members of a tested target group. The teacher (subject guarantor) can get a higherquality feedback which is necessary for his/her successful work. These elements are the extended elements, so they may not always be required but they can be very useful for the teachers (subject guarantors) and they can play the role of useful tools for research.

#### 2.2 The Proposal of the Extended Elements

The useful tools for the process of high-quality feedback development can be the 'extended elements of the question objects' ( $EE_Q_O$ ). The proposal of their formal description can be stated as follows:

$$EE_Q_O = [Rea, Bel, Dif, Com]$$

where

*Rea* is the reason or reasons for the given answer;

*Bel* is a level of belief in the correctness of the given answer;

*Dif* is a level of difficulty;

*Com* is a possible comment of a student.

The question object with the extended elements specified above can be described as Extended Question object  $(EQ_0)$ :

 $EQ_O = [Q_O, EE\_Q_O].$ 

#### 2.2.1 The Extended Element No. 1 (Rea)

The reason/s (*Rea*) for selected answer/s can serve for better understanding of the reasoning used in answering. The tested person (student) should describe his/her thought process, which led him/her in selecting the right answer/s.

#### 2.2.2 The Extended Element No. 2 (Bel)

The belief in the correctness (*Bel*) of the selected answer/s could have four levels. The tested person (student) should express how much he/she is sure or uncertain with his/her answer.

The proposal of the suitable levels is as follows:

- Absolutely sure;
- Rather sure;
- Rather uncertain;
- Completely uncertain.

#### 2.2.3 The Extended Element No. 3 (Dif)

This extended element stands for the difficulty (Dif) of electronic questions, which question object can generate. The tested person (student) should express his/her point of view on the difficulty of the answered question.

The proposal of the suitable levels is as follows:

- Extremely difficult;
- Difficult;
- Easy;
- Very easy.

#### 2.2.4 The Extended Element No. 4 (Com)

Comment (*Com*) of a tested person (student) can bring very useful information for the teacher and especially for the subject guarantor. It is a challenge for gifted students to formulate his/her proposals which can lead to an improvement of the course.

The formulation of useful comments should be promoted. For example, the authors of useful comments can obtain some credit points.

# 2.3 Proposal on Practical Embedding of Extended Elements

From the author's point of view four 'extended elements of the question objects' described above could be implemented as is shown in Figure 1. The author assumes that the graphical design should not be very complicated because it can disturb the concentration of the tested persons (students).

🛱 Question 13 / 25	
Tick operation systems	
🔲 Windows 7	
🔲 Python	
🔲 Windows Vista	
🦵 Visual Basic	
🦵 Linux	
The reason/s for my selection of answer/s:	
My belief in the correctness of selected ansv	ver/s⊣ ⊢My opinion on difficulty of this electronic question⊣
<ul> <li>Absolutely sure</li> </ul>	C Extremely difficult
C Rather sure	C Difficult
C Rather uncertain	C Easy
C Completely uncertain	C Very easy
My comment:	

Figure 1. Electronic Question Generated from a Question Object with Extended Elements – Possible Graphical Layout

Source: Own

The concrete possible tested person's (student's) response is shown in Figure 2. Tested person's (student's) point of view presented by these specific data may represent a very valuable feedback for the teachers and subject guarantors.

Question 13 / 25	
Tick please operation systems.	
☑ Windows 7	
🥅 Python	
🔽 Windows Vista	
🥅 Visual Basic	
🔽 Linux	
The reason/s for my selection of answer/s:	
ASCII is a code. Python and Visual Basic are the pro	gramming languages.
My belief in the correctness of selected answer/s	My opinion on difficulty of this electronic question
Absolutely sure	C Extremely difficult
C Rather sure	C Difficult
C Rather uncertain	C Easy
C Completely uncertain	<ul> <li>Very easy</li> </ul>
My comment:	
More possible answers could be offered.	

Figure 2. Example of a Tested Person's (Student's) Response

Source: Own

# 3. GIFTED STUDENTS' ROLE

Gifted students often play an important role in building a high-quality core of a study group and their capabilities and ideas call for the use. These students should

be recognized in time and their capabilities developed (Hrubý 2010). The valuable properties of these students are especially: flexibility in point of view, self-confidence, no fear of being wrong, the ability to distinguish between fact and opinion. Gifted students often ask unexpected and sophisticated questions, which are meaningful to them, and which do not have easy answers. Especially gifted students can change answering electronic questions to a dynamic process of study subject development.

# CONCLUSION

The described approach is the result of the author's research. The proposal of 'extended elements of the question objects' is based on the author's own experience. The author is convinced that described theory can be further developed and can bring positive effects into the educational processes. The core of the article (and the research) is a proposal of 'extended elements' and their description. The next step of the research could be a formulation of hypotheses which can be rejected or not rejected.

Every human being is a unique individuality. The more a teacher knows about contemporary education level, experience, communication skills, cooperation skills, cultural background, interests, motivation, personal goals and attitudes of his/her students, the better he/she can tailor study materials, suitable examples and projects for them. The 'extended elements of the question objects' can bring a higher-quality feedback in two aspects of these objects usage. The question object can generate the electronic questions for two fields of their use:

- an electronic question can be a component of a self test;
- an electronic question can be a component of a test.

In case of self tests, it should be up to the student's freewill if he/she wants to send the data to the teacher or subject guarantor. The key role is played by extended element No. 4 (*Com*). Students' comments can help to improve the teaching of the subject.

In case of tests, the extended element No. 1 (*Rea*) seems to be the most valuable for obtaining the objective results. The other three extended elements can also be useful but it is probable that only best students (gifted students) will have time for the completion of the extended element No. 4 (*Com*).

The deeper insight into the problem of the described 'extended elements of the question objects' can be done in the future. For their qualified use in education the points of view the psychology experts and the sociology experts should also be implemented. This topic also offers the research of the influence of the students' socio-cultural characteristics with connection to the concrete students' responses. Especially gifted students can play an important role in connection with the usage of 'extended elements'.

#### REFERENCES

- Hrubý, M., 2011: Electronic Questions Support for Studies. Proceedings of the 8th International Conference on Efficiency and Responsibility in Education (ERIE 2011), Prague, Czech University of Life Sciences Prague, 2011, pp. 102-109, ISBN: 978-80-213-2183-0
- Hrubý, M., 2010: Possibilities of the Gifted Students' Development at the University of Defence. New Challenges in the Field of Military Sciences. Proceeding . [DVD-ROM]. Budapest, Bolyai János Military Technical Faculty of Zrínyi Miklós National Defence University, 2010, 7 pp., ISBN: 978-963-87706-6-0
- Hrubý, M., 2009: Selftest an Important Part of Modern Study Materials. New Challenges in the Field of Military Sciences. Proceeding. [CD-ROM]. Budapest, Bolyai János Military Technical Faculty of Zrínyi Miklós National Defence University, 2009, 8 pp., ISBN: 978-963-87706-4-6

# EDUCATIONAL ASPECTS OF THE USE OF MOBILE PHONES IN UPPER SECONDARY SCHOOL

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**Abstract:** This article presents the results of a diagnostic survey conducted among upper secondary school teachers concerning the use of mobile phones at school. The diagnosis presented hereafter is a point of reference for educators who wish to adapt more modern educational practices in regard to the use of information and communication technologies (ICT) in school.

Keywords: mobile phone, mobile learning, teacher, upper secondary school

#### **INTRODUCTION**

Mobile phones and compatible information-communication technologies are important factors affecting the emergence of new social relationships. We are witness to the creation of next-generation devices which, owing to their small dimensions, provide convenient access to information on the move (Peters 2007). Mobile phones have become an attribute of people living in an information-based society. They are kept close – in bags, on laps and in pockets – and their screens are easy to hide away from prying eyes. Mobile devices supplement human senses in the process of acquiring and storing information, and the creation of new structures. (Alexander 2004). The mobile phone market at present is designed for a wide range of consumers, each having their own lifestyle and interests. Some phones are small and discreet, some are chosen for their fashionable appearance and some offer only basic functions, while others provide a wide range of services.(Attewell 2005). These features have allowed for the adoption of these devices for mobile learning – that is to say, devices with an operating system conducive to realizing educational goals.

Mobile technology is becoming increasingly common in the process of learning (such as children developing new language skills via mobile devices) and teaching. New mobile technologies provide more opportunities for educational services, as

well as media relevant to the students' interests. (Sharples, Taylor, Vavoula 2010).

Mobile learning is a ripe platform for innovation, but it's important to realize that success – the appropriate use of a device – is dependent on the human element. (Kukulska-Hulme 2007). Such actions need to be suitably planned, with the teacher having the relevant competency and experience necessary. The fulfilment of these conditions will enable the use of mobile phones as devices allowing the student to contribute to the process of learning through sharing ideas, discoveries, research, experiments, and discussions. (Laurillard 2007). An effect of these kinds of activities, while learning at school, is the 'activation' of each student with a mobile phone.

#### 1. PURPOSE, JUSTIFICATION OF RESEARCH AND RESEARCH PROBLEMS

The fact that mobile phones result in unintended consequences does not mean that we cannot plan effectively and improve their integration within the process of education. Enhancing the quality of education and adapting methods of learning and teaching to new opportunities that mobile devices provide is a challenge for teachers. Firstly, one should determine the opinion of teachers on the use of mobile phones in education. This research design focuses on upper secondary school teachers who are responsible for the education of people about to begin an adult and independent life. Young people – between the ages of 16 and 20 – attend this form of school. The purpose of this research is to describe situations concerning the use of mobile phones in upper secondary schools, as well as the characteristics of teachers' attitudes towards this medium.

Based on the purpose above, the following research problems were formulated:

- Are students of the surveyed teachers using mobile phones during breaks and during lessons?
- What are the possibilities of using mobile phones by students in the process of education in the opinions of the surveyed teachers?
- What are the dangers of using mobile phones by students in the process of education in the opinions of the surveyed teachers?

#### 2. METHOD OF RESEARCH

The primary research method used was a diagnostic survey, in which a questionnaire – aimed at upper secondary school teachers – was used (Palka 2006). The most important information which was analyzed was obtained in the course of carrying out this survey. In the period from April to May 2012, the questionnaire form was completed by 72 teachers from four provinces situated in Poland.

## **3. RESULTS OF RESEARCH**

The popularity and functionality of mobile phones result in them being used by students not only at home, or in their free time, but also during school hours. This is confirmed by upper secondary schools teachers, indicating that 97% of students use mobile phones during breaks (Figure 1).



Figure 1. The use of mobile phones by students during school breaks between lessons N=72



Figure 2. The use of mobile phones during lessons at school, N=72

Source: Own research

Source: Own research

Students also tend to use their mobile phones during lessons. In the survey, observing such a situation was confirmed by 57% of teachers (Figure 2). This situation is not usually acceptable, since 54% of surveyed teachers confirmed that they caught students copying assignments from mobile phones during tests. A negative attitude from teachers towards exploiting this medium is confirmed by the statements of respondents; those surveyed (100%) are in favour of proposing regulations that prohibit the use of mobile phones on school grounds. However, introducing such regulations prevents the implementation of the school curriculum on this medium; this perhaps indicates a lack of knowledge from teachers regarding the educational potential of mobile devices.

It is worthwhile mentioning that the legislation in school concerning the use of mobile phones within the facility is also disobeyed by teachers. Findings indicate that 31% of surveyed teachers admitted to using mobile phone during lessons. This situation affects the image of teachers who enforce provisions of the rules which they are not obeying and are, in fact, breaking them during lessons in the presence of students.

There is no doubt that one of the most important advantages of mobile phones is the ability to contact another person anywhere within the reach of a given network. This attribute is being used by teachers for contacts in teaching and educational matters with both students and their parents. Research has shown that 89% of the teachers

surveyed contact parents and students for educational matters equally often.. Mobile phones, due to their mobility, naturally fulfilled the need of being able to immediately contact parents or students for a variety of reasons. The mobility of phones enables a direct conversation with a parent immediately after an incident of an alarming nature. At Polish schools, contact between teachers and parents most frequently concerns the behaviour of the student during school hours, their educational achievements, matters associated with treating the student, and organizational issues.

In the survey, a question concerning ways of using mobile phones at school was posed to teachers. Out of specific possibilities, respondents chose the ones which, in their view, are most appropriate in achieving the objectives of education. The results obtained (Table 1) indicate that the most useful feature of mobile phones – as indicated by 60% of the respondents – is the ability to take photographs, and record videos and sounds related to the subject matter.

Multimedia devices, such as digital cameras or voice recorders, have become basic functions of mobile phones. Therefore, teachers conducting field or classroom activities do not require the school to supply them with such devices, since the vast majority of mobile phones are already equipped with them. What students hear or see can be stored not only in their own memory, but also in the memory of their mobile phone. Material captured by the student can be developed in detail and it is possible to connect it with material from another student, generating new information and new ideas (Huk 2008).

Table 1.

Possibilities	Teachers %	Ν
Sending homework to students' mobile phones	14%	10
Informing students about evaluations	28%	20
Seeking information on the Internet via mobile phone by students	50%	36
Using educational applications for teaching specific subjects	26%	19
Taking photographs, and recording videos and sounds related to the subject matter	60%	43
Reading electronic versions of books	29%	21
Creating short notes during classes	19%	14

#### Possibilities of using mobiles in the education process

Online contact with an expert from the specific subject	33%	24
Recording the lesson onto the mobile phone	13%	9

#### Source: Own research

Apart from multimedia possibilities, mobile phones are equipped with devices allowing them to connect to the Internet. This function of the mobile phone was the second most commonly selected by teachers (50%) since it enables pupils to seek information on the Internet in any place within the reach of the mobile operator or a wireless network. Mobile phones with the ability to browse through the Internet create new didactic situations characterized by obtaining information outside the school building. This feature is especially useful during teaching trips, when students can compare and expand information and places with information from the Internet. It should be noted that monuments and contemporary places of culture often feature QR Code systems (Quick Response), enabling mobile phones to obtain all the relevant information by scanning the codes. The possibility of students and teachers being able to connect to the Internet via mobile devices is a giant step in the direction of modern education.

Thirdly, teachers (33% of the respondents), for using mobile phones in the process of education, consider the possibility of online contact with experts in a particular subject as a way of gaining new information. The purpose of this method is not only obtaining information from a trusted source, but also the development of skills in formulating questions and having discussions.

Mobile phones also provide the possibility of reading electronic books. Out of the respondents, this possibility was selected by 29% of teachers. The fifth most considered option is the ability for teachers to inform students about their evaluations (28%).

In sixth place (26% of the respondents), is the function of using educational applications for teaching specific subjects. Contemporary mobile devices offer the possibility of installing different educational applications: e-books, foreign language learning, logical, mathematical, natural, musical, plastic, chemical, physical games, and a lot of others. Teachers very often do not know about applications dedicated for mobile phones and so are not able to use them in the implementation of educational objectives. The costs of such applications and their incompatibility with different operating systems are also an obstacle.

The next choice – as indicated by 19% of teachers surveyed – was the category concerning the creation of short notes during lessons. Achieved results indicate that this function of the phone does not have the widest spectrum of applications in educational actions. Contemporary Polish schools are still based on writing information on a sheet of paper, since this is more comfortable and cheaper for both the students and the teachers.

For 14% of surveyed teachers, sending homework via mobile phone constitutes one of the forms, thanks to which, educational objectives can be fulfilled. Using mobile phones in this way is, unfortunately, expensive and requires the preparation of a suitable educational platform adapted to mobile learning. Teachers fear that sending homework contents en masse from their phones to students would incur significant connection costs. Moreover, the physical absence of the teacher causes the need for other ways of raising the level of students' motivation. The anonymity of handing over tasks by mobile network requires placing a stronger emphasis on the content. Therefore, the dialogue of the teacher with the student in communication via mobile phone must be adequate to meet the needs of students to ensure their understanding (S. Juszczyk 2003).

The last chosen category by teachers concerned recording lessons onto mobile phones -13%. The small number of teachers selecting this category is caused by teachers' anxieties concerning the improper use of recorded materials. Classes recorded by a student on a mobile phone could be processed and posted on the Internet, ridiculing the teachers.

Table 2.

Threats	Teachers	N=72
	%	
Thefts of mobile phones	40%	29
Using mobile phones for copying e.g. during tests	88%	63
Recording the lesson without the permission of the teacher	76%	55
Using mobile phones for filming people without their consent	86%	62
Using mobile phones for photographing people without their consent	79%	57
Using phones during the lesson without the permission of the teacher	69%	50
Distraction of students during the lesson	76%	55
Discrimination against students who do not have a mobile phone or have an older model.	35%	25

Threats of using mobile phones in the education process

1370 7	Overloading the school wireless network	13%	9
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#### Source: Own research

Using mobile communications in the education process provides not only a lot of opportunities but also many risks that are noticed by teachers participating in the research, more clearly so than the possibilities. 88% – the largest selection – of teachers think that the main threat is using mobile phones to copy tasks during tests. Thanks to calculators, web browsers, and receiving short text and image information (SMS & MMS), students solve tests in a dishonest way, blurring the real image of the pedagogic diagnosis. The second most commonly selected answer by teachers is threat concerned with using mobile phones for filming people without their consent – 86%. Another threat is using mobile phones for photographing people without their consent their consent – 79%.

Teachers are also afraid of students recording lessons on their mobile phones without the teachers' permission- 76% of respondents. In talks conducted in the course of the research, teachers admit that such situations are happening. Lessons recorded by pupils are being processed in special computer programs in order to ridicule the given teacher, and are then being posted on the Internet.

Students having mobile phones can use them during the lesson not only for the aforementioned situations, but also to communicate with their parents or peers. Conducted research shows, in this respect, that the frequency of students' contact with parents through mobile phone is changing along with age; older children are more likely to contact their peers than parents (Huk 2010: 215). The unexpected sound of a phone ringing during the lesson disrupts its continuity, and distracts students- as is confirmed by 76% of respondents. Among the surveyed teachers, 69% are afraid of students using their phones without their permission. Next, 40% of teachers fear a theft of mobile phone on school grounds. These situations are not conducive to building a sense of security among pupils

Processes occurring in the school community are a reflection of what is happening outside the school building. The kind of mobile phones held by a pupil sharpens divisions between wealthy students and the poor. Wealthier pupils are placed higher in the peer hierarchy than poorer pupils. The discrimination against students who do not have a mobile phone or have a worse model is another threat, which was confirmed by 35% of surveyed teachers. The fear most rarely chosen by teachers concerned overloading the school wireless network – 13%.

#### CONCLUSION

The surveys enabled us to make a diagnosis concerning the use of mobile phones in upper secondary schools, as well as teachers' attitudes towards this medium.

At Polish upper secondary school, the vast majority of pupils use mobile phones during breaks between classes. More than half of the surveyed teachers believe that students also use phones during lessons. Using this media both during breaks and during lessons is forbidden in the school regulations of all respondents.

Nearly 1/3 of teachers admitted to using a mobile phone during lessons, which is not in accordance with school regulations.

In the teaching process, teachers most often use mobile phones for taking photographs, and recording videos and sounds concerning subject matter. Teachers are occasionally using educational applications dedicated for phones.

For surveyed teachers, the main threat associated with mobile phones is using these devices for copying during tests.

Mobile education is not popular in the Polish educational system. The model of the learning process, in which tablets or mobile phones are being used, is not attainable for a state school at present. Introducing such a model of teaching, supporting the process of developing the competences, requires a large financial outlay to provide the educational platform, training of teachers, equipping schools with adequate teaching means and a change in the attitudes of teachers (Huk 2012). Thus, there appears a challenge for institutions dealing with teacher education, which would confirm the words that mobile phones are lending wisdom to the world. Just like a magic wand, in the blink of an eye, it means every place in which we will find ourselves with our mobile phone would become intelligent. The ability to connect to the Internet, even when the sun is shining in our face, shows us that information is finally in the right; it is a part of life, a part of the world, and we can get it by being in the real world, rather than isolation (Levinson 2006).

#### REFERENCES

- Alexander, B., 2004: Going Nomadic: Mobile Learning in Higher Education. EDUCAUSE Review, Vol. 39, No. 5, 2004, pp. 29, ISSN: 1527-6619
- Attewell, J., 2005: Mobile technologies and learning. A technology update and mlearning project summary, 2005, pp. 2, ISBN: 1-84572-140-3
- Huk, T., 2008: Komputer w procesie kształtowania umiejętności kluczowych [The computer in the development of key skills], Wyd. Difin, Warszawa, ISBN: 978-83-7251-925-2 [In Polish]
- Huk, T., 2010: Wychowawcze i edukacyjne aspekty telefonii komórkowej [Educational and educational aspects of mobile] In: Language -Communication - Media – Education, red. B. Siemienicki, T. Lewowicki, Wyd. Adam Marszałek. Toruń 2010, ISBN 978-83-7611-684-6. [In Polish]

- Huk, T., 2012: Opportunities and Risks of the Use of the Mobile Phone in the Process of Education. The New Educational Review. Vol. 30, No. 4, 2012, pp. 258. ISSN: 1732-6729.
- Juszczyk, S., 2003: The chosen pedagogical, sociological, and psychological aspect of the distance education. The New Educational Review. Vol. 1, No. 1, 2003, ISSN: 1732-6729
- Kukulska-Hulme, A., 2007: *Mobile Usability in Educational Contexts: What have we learnt?* International Review of Research in Open and Distance Learning, Vol. 8, No. 2, 2007, ISSN: 1492-383
- Laurillard, D., 2007: Pedagogical forms of mobile learning: framing research questions. In: Mobile Learning: Towards a research agenda. Occasional papers in Work-based Learning (1). WLE Centre, Institute of Education, London, pp.153-175.
- Levinson, P., 2006: Telefon komórkowy. Jak zmienił świat najbardziej mobilny ze środków komunikacji [Mobile. The Story of the World's Most Mobile Medium and How It has Transformed Everything!] Warsaw Literary Publishing MUZA, Warsaw 2006, pp. 156–157, ISBN: 83-7319-824-5 [In Polish]
- Palka, S., 2006: Metodologia. Badania. Praktyka pedagogiczna. [Methodology. Research. Teaching Practice.] GWP, Gdańsk. ISBN 83-60083-30-4 [In Polish]
- Peters, K., 2007: *m-Learning: Positioning educators for a mobile, connected future.* International Review of Research in Open and Distance Learning, Vol. 8, No. 2, 2007, ISSN: 1492-383.
- Sharples, M., Taylor J., Vavoula, G., 2010: A Theory of Learning for the Mobile Age Learning though Conversation and Exploration Across Context. In: Medienbildung in neuen Kulturräumen. ie deutschprachige und britische Diskussion. B. Bachmair, Wiesbaden 2010, pp. 88, ISBN: 978-3-531-16755-8.

# THE IMPORTANCE OF VISUALISATION IN EDUCATION

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**Abstract:** Visualization is a possibility of perceiving and processing information in a graphical form. The advantage is the universal clarity regardless of the diversity of languages. Visualization enables quicken communication communication and creates a unified and comprehensive tool for everyday communication. This paper describes the importance of visualization as an essential element not only in acquiring knowledge of students, but also in lifelong learning.

Keywords: visualization, ICT, education, lifelong learning

#### **INTRODUCTION**

We encounter the visual communication every day. Human sees everything happening around him by eyes, receives back some information and responds to him according to the current situation. Communication with the image and using the image, is now inevitable. Examples are not only icons that surround us and have different meanings. The enormous importance is visualization on the Internet, where information is presented in various forms especially visual experience.

The visualization, however, is a part of all scientific fields such as construction, engineering, architecture, but also in geography and chemistry. Digital technology is becoming their organic components and brings a significant discovery of new knowledge, principles, and a shift in the perception of existing theory. This was still significantly recognizing for most of the teachers, students and pupils of various grades of school systems. (Bílek 2009).

Visualization is thinking view of the fact, when the results are shown so as to be perceived by the visual receptors. In education, the visualization is associated with the application of rules clarity. By Průcha (2009) visualiation of information has universal clarity regardless of the diversity of languages, decoding speed, relativity, and more. The danger is weakened by Průcha (2009) rational operations, hypertrophy of sensory impressions, and often ambiguity of the information. The current trend has allowed just through visualization speed up communication and creates a single and comprehensive tool that allows communication in routine matters, but also for the unification of terms in science and is a key of importance of education at school and lifelong learning.

Prucha (2009) also points out that visual expression using different brands, diagrams and symbols becomes a permanent part of the communication of many professions and therefore it is necessary to pay attention to the overall level of visual and aesthetic impact of phraseology, as it creates a new visual culture, a new sensibility of person. Through the vision reinforces the imagination. In this sense eyes "thinking and feeling" and still strongly applies in interpersonal communication. It must however distinguish a passive visual culture, that is correct and well to be able to perceive and understand visual information. And active visual culture.

Active visual culture is characterized by the fact that a man is able to visually communicate and create visual communication itself. To strengthen this ability is also necessary to strengthen the development of visual culture by using didactic tools. Interdisciplinary in conjunction with the visual perception is often in some countries such as Germany replaced by subject termed "Science". This trend is not yet usual in the Czech Republic, although it would allow the current curriculum.

The visualization is encountered in science, where it is an important tool for performing the role of cognitive but also the presentation of science and technology. The advantage is that the computer technology in cooperation with visualization allows the development of critical thinking (Wiebe et al, 2001).

#### 1. HISTORY OF VIZUALISATION

Visual attribute has been used since the second half of the 19th century thanks to technological breakthroughs associated with the use of photographs. This milestone is described by Šimůnek (2009) as a visual or image turn. In connection with the visualization of culture was gradually developing visual literacy. This does not directly literacy clearly specified research subject or a clear goal it is therefore crucial search context of visual perception and social environment. The first indication for visual literacy used in 1969 John Deebs a need to study the image folder and physiognomic vision process, including the need for interdisciplinary cooperation in the study of visual culture. Visual literacy has many definitions, which varies according to the discipline that gives this literacy in context. Definition of International Visual Literacy Association describes visual literacy as an interdisciplinary effort to understand and learn about the process of visual communication as an effort to define the relevant knowledge, skills and competencies that are required for the acquisition of trivia and other skills for

successful learning process. The key is understanding different perceptions of reality.

## 2. VISUAL PERCEPTION

Visual perception, visual information processing and the subsequent creation of adequate concepts for pupils is not only an essential component of science education. Visualizations are associated with cognitive activities. Visualization allows the application of scientific concepts of science education in a new context (Wiebe et al. 2001). Visualization can also be referred to as "mental image" or "mental representation" (Duval 1999). Graphical presentation represents the onset of ICT in education in all types of school systems essential part of educational materials (Bílek 2007).

Visualization is characterized by Seifert (2004) in Bilek (2007) as "visual performance" of things, phenomena, processes and emotions. Visualization may not always fully replace spoken words but the targets can be focused on:

- The concentration of attention of listeners on the essence of the presented content.
- For attracting listeners.
- Reducing the burden of teachers.
- Helping in the orientation of the audience.
- To facilitate the understanding of presented information.
- To access to the substance of presented content.
- The deepening and extension of the spoken word
- To support remembering of the presented contents
- To encourage the growth opinion on the presented content.

The key is visualization and creativity, which greatly enhance efficiency. It mainly on three aspects:

- Planning of visualization.
- Basic (support) points of visualization.
- The rules for composition visualization.

For planning are especially important answers to the following questions:

- What I want to present?
- What is the goal of prepared presentation (purpose of the presentation)?

- Who do I want to inform or persuade (target group)?

In addition to cooperation in the study of visual culture is often seen in visual literacy also called decontextualisation and recontextualization which indicates removing visual information from the original context and adjusts its original meaning. Unfortunately, at present, with visualization decontextualisation and recontextualization often encountered due to the massive distribution of photos in various photo agencies, and social networking sites for sharing photos.

Visualization in the context of thinking can be divided into four categories (Gilbert 2005)

- 1. Consideration includes the creation of new images by their repetition and existing elements. This is the basis for a visual analogy.
- 2. Learning physical skills first creates a visual perception which defines the nature of physical movement arising in the performance of a specific movement (for example tuning the radio dissecting dead bodies).
- 3. Understanding verbal description visualization are generated based on propositional statements (for example the structure of crystalline solids formed on the basis of verbal descriptions).
- 4. Creativity can be either a reassessment of the meaning of an existing image or changing the frame of reference.

#### **3 VIZUAL MATERIALS AS AN EDUCATIONAL TOOL**

Among the image (sometimes iconic) tools which the subject expresses in two dimensions in a continuous surface. They are divided in the first approximation to the actual show (photos, pictures, diagrams, and animated display assembly) and display slideshows (with slide, slide film transparent for overhead projector, film, movies in analog or digital form, etc.) (supplemented by a Pachmann Hofmann, 1981 in Bilek et al, 2007). Photos are the most faithful depiction of reality (for example photo chemical plants, chemical products chemical apparatus, etc.). In terms of the formalization of the visual material at least formalized for example they contain the recipient abundance of irrelevant or too detailed information that can complicate the understanding of the depicted object or phenomenon.

An integral part is also a symbolization that plays in chemistry and other disciplines significantly specific role (Holada 2000 in Bilek et al. 2007). Contemporary symbolism aims above all its knowledge about objects and phenomena between people and technology, symbolized by identifying objects or phenomena, overcoming language barriers, etc.

The projected projections allow high magnification, rapid changes in the image and highlighted with light projection options and a stronger effect on increasing the attention of the students (Pachmann Hofmann 1981 in Bilek 2007). Individual

tools ranked the projected (mediated) showing we can still distinguish to static (slides, transparent, static object (picture, model, natural, etc.) using the projected visualizer (video)) and dynamic (film, video, computer animation and simulation, dynamic object (the course of chemical experiment a moving model, etc.) using the projected visualizer - camcorder).

Mares (1995) in Bilek et al (2007) notes that the way to learn from the visual material for example how to get by with visualization his new knowledge usually not in school attention. A broad concept of "clarity" is often not acting sufficiently suitable description of a graphical display in the classroom and thus acquires legitimacy analysis of visual material from different perspectives. Visual materials can be divided into pictures with visualization functions (for example Levin Anglin Carney 1987 Mares 1995 Bilek, Konířová, Pear 2002 in Bilek et al. 2007):

- Decorative.
- Representing or illustrating.
- Organizing.
- Interpreting.
- Transforming.

Picture of with visualization prevailing decorative features factually unrelated to the text. May be included in the textbook for example, to fill the empty space or to make the text more interesting for the general reader and therefore more marketable.

Overall, it can be divided into visual information (Beránková 2009):

- Pictures of informative character (eg pictograms).
- Scientific images (eg X-ray images, pictures of nature science, geovisualization).
- Media images (eg advertising, film).

# 4. THE ELEMENTS OF VISUALIZATION AND COMPUTER PRESENTATIONS

As support points of visualization should be further in relation to the contents reflect the media used for presentation (different types of boards, overhead projectors, data projectors, etc.) and design elements (text, graphics, symbols, diagrams, etc.).

The key to good visualization of the following elements:

- Readability - not suitable script, the computer processing is recommended simple "sans" fonts eg Arial, Calibri.

- Ensuring the cultural practices of reading texts reading texts and presentation processes in the "left to right," use upper and lower case letters,
- Layout and orientation of the text text border, highlighting essential parts, block diagrams, etc.
- The use of color "less is often more" contrast text and background (white or light yellow text on a dark blue background), the use of symbolic meanings of colors (eg black objectivity, fairness or highlighting negativity blue friendship, pragmatism, highlighting the cool red signal color highlighting aggression green positive character clear path, nature, emphasizing peace and hope) (Drtina, Chrzová, Maněna 2006 in Bilek et al. 2007).

Other important elements of the visualization of data presentation in the form of tables, graphs and diagrams. Here are the following types:

- Lists and tables.
- Curve graphs (diagrams).
- Bar graphs (diagrams).
- Circular and pie charts.
- Organizational chart.
- Flowcharts and network diagrams etc.

Graphs are important tools in science for a very long time. Key is then the correct interpretation of presented data. Happonen and Aksela (2011) describe that often occur in pupils' difficulties in distinguishing x and y axes.

The elements are arranged in a certain composition which for the presentation must observe certain rules. Seifert (2004) in Bilek et al (2007) distinguishes rules into three basic areas:

- Layout of elements on the page presentation.
- Logic and arrangement of elements in terms of content and presentation of the course.
- Colors and forms.

The page layout is an important element of the presentation which can facilitate in a number of presentations distribution areas into smaller sections to determine the gold chain etc. In computer presentation programs are preferably prepared using patterns sites called "templates". This is a draft layout of text, image, parts and combinations thereof (eg, prepared slides in a presentation in MS PowerPoint). The structure and logic of the site and the entire presentation is determined by the following aspects:

- Symmetry.
- Transmission.
- Rhythm.
- Dynamics.

When using colors and forms of presentation of the basic elements of visualization is important to realize that this is the highlight meanings of these elements. Their use is particularly meaningful:

- Highlight important information.
- Illustrating the context.
- References to the connection between presentations.
- Highlighting following the presentations.

Urbanová and Čtrnáctová (2008) pointed out that presentation is a good element for visualization of the curriculum, but the use of graphic elements it is important to use the appropriate graphic that does not pay the essence. Veřmiřovský and Bilek (2010) describe the importance of multimedia presentations but that is to be used as an accessory when not to use a real object.

When visualization of the curriculum, for example through computer presentations in PowerPoint or Impress applies especially information and formative function, motivating and stimulating function and ergonomic control and respect for individual pupil learning pace.

The basis for the creation of PowerPoint presentations is to analyze the content and structure of the material of the topic, a form of visualization and active way of learning pupils during lessons and outside. The content and structure of the curriculum in line with current trends in education need not necessarily be based on detailed knowledge of the subject matter, but rather the understanding of basic concepts and far more practical application of individual elements and their compounds. The starting point for the representation of the curriculum is to search on the Internet, which allows to obtain not only a lot of textual information but also a variety of images and video clips. Then using video clips along with visualization with own images and simulations created with the appropriate programs for effective and most efficient visualization of the curriculum. The active method of subject learning can take different forms and forms usually carried out by suitably awarded learning tasks.

# 5. VIZUALIZATION AND DISTANCE LEARNING

On eyes we operate by a simple text supplemented by visual documentation, photographs, videos, then operate to hearing aid music samples read words. On

senses we can also act in combination - with the help of multimedia demonstrations interactive animations and visualization. E-learning offers us a wide range of technology options that can improve learning. In principle, however, also invalidate (Kopecký 2006). The basic elements of distance learning include temporal and spatial separation of the individual studies (Soukup, 2004). At present, we meet the principles of synchronous and asynchronous communication. Keng-soon (1998) describes that is better for distance learning using the highest interaction capabilities that meet the needs of learners. A common factor in distance education, the availability and price, where unfortunately there are still students who choose this distance education can not afford. The research results indicate that visualization and more concrete examples of personal teacher feedback is very important element in the educational process of the adult population either through distance or lifelong learning the rules still apply Comenius about didactics, playing and partnerships (Soukup, 2004).

#### 6. VIZUALIZATION, VIRTUAL REALITY AND SIMULATIONS

Visualization is currently associated with virtual reality, which is technologically possible, but on the other hand, the education is unfortunately still limited application. By Ferreira (2008) optimal would be develop a comprehensive cognitive illusion, where the learning took place in virtual worlds. Three-dimensional computer modeling and virtual reality can combine and extend existing range of methods for different disciplines (Horne, Thompson 2008). Simulations allow for independent learning activity, improved motivation, student involvement, natural semantics, safe space and cost savings. From simulators are also required large possibility of visualizing the inputs and outputs of the model (Kofránek, Tribula 2007).

Simulations are used in a wide range of teaching and learning contexts. To improve memory, cognitive simulations are used for example in agricultural mechanics, fluid mechanics, engineering, interactive digital media, virtual labs, science education in general and in terms of applications such as provision of health care (Koh, 2010). Another example is the use of simulation and visualization of geographic data using specialized software (Pang 2001, Herman 2013). The simulation tool can also be found in robotics where the aim is to improve the visualization of engineering applications at remote (Calkin et al. 1998). Eiks et al (2012) describes the use of images, three-dimensional images and an animation in chemistry where key is the use of visualization to describe to microscopic to submicroscopic level. The advantage of visualization in chemistry is refute some misconceptions reactions at the molecular level. But as the authors describe the key is correct classification of visual elements in context. Myška et al (2009) describes visualization in chemistry connecting with LMS and some visualization programs such as Jmol and JChemPaint allowing visualization of molecules.

# CONCLUSION

Visualization is an integral part of education at all types of schools in different forms from full-time education after distance learning. The visualization also encounter every day in life, whether it is a static image information associated with certain activities or symbols or a dynamic visual information in the form of computer programs and animations used eg in connection with touchscreens. The key role of visualization is to facilitate remembering at one-offs, as well as routine operations. The relation of distance learning and visualization is an important element of the teacher, not only in distance but also lifelong learning, the teacher is not in its usual role of the learner, but rather in the role of guide - a tutor.

Overall, the visualization have positive significance for man which is applied in education. These include the understanding of the structure and processes in the microworld, understanding of the connections between the visualized elements simulation processes hardly realized during the preparation of pregraduate students, etc.

#### REFERENCES

- Beránková, R., 2009: Visual communication and visual literacy outside the arts paintings in everyday life, the visual language and how do we communicate with them, Rigorous thesis, Masaryk University in Brno, 2009, 134 pp. [In Czech]
- Bílek, M., et al., 2007: Selected aspects of the visualization science curriculum subjects. M&V Hradec Králové, Hradec Králové, 2007, 180 pp. ISBN: 80-86771-21-0. [In Czech]
- Bílek, M., et al., 2009: Interaction of real and virtual environment in early science education: tradition and challenges. Gaudeamus, Hradec Králové, 2009, 144 pp. ISBN: 978-80-7435-019-1
- Calkin, D., et al, 1998: Visualisation, Simulation and Control of a Robotic System Using Internet Technology. 5th IEEE International Advanced Motion Control Workshop, Coimbra, Portugal, 1998, pp. 399 – 404, ISBN: 0-7803-4484-7
- Duval, R., 1999: Representation, Vision and Visualization: Cognitive Functions in Mathematical Thinking. Proceedings of the Annual Meeting of the North American Chapter of the International Group for thePsychology of Mathematics Education. Mexico, 1999, pp. 1-25.
- Eilks, I., et al., 2012: The role and potential danger of visualisation when learning about sub-microscopic explanations in chemistry education. CEPS Journal, Volume 2, Issue 1, 2012, pp. 125-145. ISSN: 2232-2647

- Gilbert, J., 2005: Visualisation: a metacognitive skill in science and science education, Visualisation in Science Education, 2005, pp. 9 27. ISBN 978-1-4020-3613-2.
- Happonen, M., Aksela, M., 2011: Graphs in upper secondary school chemistry education. ESERA 2011 Teaching and learning science, Lyon, France, 2011, pp 77 – 81. ISBN 978-9963-700-44-8.
- Herman, L., 2013: Adaptive 3D visualization of cities. Sborník příspěvků ze symposia GIS Ostrava 2013 - Geoinformatics for Society. Ostrava: VŠB – Technical University Ostrava, 2013. s. free pages, 10 pp. ISBN 978-80-248-2951-7. [In Czech]
- Horne, M., Thompson, E., 2008: The role of virtual reality in built environment education. Journal for Education in the Built Environment, Volume 3, Issue 1, 2008, pp. 5-24. ISSN 1747-4205.
- Keng-Soon, S., 1998: Interaction:What Does It Mean in Online Distance Education?. ED-MEDIA/ED-TELECOM 98 World Conference on Educational Multimedia and Hypermedia & World Conference onEducational Telecommunications. Proceedings. 1998, pp. 1 – 8.
- Kofránek, J., Tribula M., 2007: Control web for interactive multimedia kidney. Centre for Education Masaryk Hospital, Ústí nad Labem. pp. 101 – 110. ISBN 978-80-86742-00-7.
- Koh, C., et al., 2010: Investigating the Effect of 3D Simulation Based Learning on the Motivation and Performance of Engineering Students. Journal of Engineering Education, Volume 99, Issue 3, 2010, pp. 237 – 251.
- Kopecký, K., 2006: *E-learning (not only) for teachers*. HANEX, Olomouc, 2006. 130 pp. ISBN 80-85783-50-9.
- Pang, A., 2001: The Educational Effectiveness of Dynamic and Interactive Data Visualization and Exploration in Geographical Education. Unpublished Masters Thesis, Department of Geography, Birkbeck College, University of London, UK.
- Myška, K., et al., 2009: *Visualization of chemical structures in LMS systems*. Research, theory and practice in the didactics of chemistry, Gaudeanus, 2009, pp. 241-246. ISBN 978-80-7041-839-0. [In Czech]
- Průcha, J., et al., 2009: *Encyclopedia of education*. Portál, Praha, 2009. 936 pp. ISBN 978-80-7367-546-2. [In Czech]
- Soukup, J., 2004: The role of visualization of in distance education. Proceedings of the III. National Conference on Distance Education in the Czech Republic in 2004, the Center for Study of University Education, vvi - National Centre for Distance Education, Praha, 2004. pp. 268 - 274, ISBN 80-86302-02-4. [In Czech]

- Šimůnek, M., 2009: Several suggestions for developing visual literacy. Media Pedagogy. Media and communication in theory and education. Czech Budejovice. University of South Bohemia in Czech Budejovice, pp. 87 – 100. [In Czech]
- Urbanová, K., Čtrnáctová, H., 2008: Creating content of the curriculum of general chemistry with respect to its graphic design. Current Trends in Chemical Curricula, Charles University in Prague, Praha, 2008. pp. 86 - 90. ISBN 978-80-86561-60-8. [In Czech]
- Veřmiřovský, J., Bílek, M., 2010: Opinions of chemistry teachers on ways of using MS PowerPoint and multimedia objects. XX. International Seminar about Chemistry education - Current trends in ICT Chemistry education. Gaudeamus, Hradec Králové, 2010. pp. 16-20. [In Czech]
- Wiebe, E., Clark, A., Haase, E., 2001: Scientific Visualisation: Linking Science and Technology Education through Graphic Communication. Journal of Design and Technology Education, Volume 6, No. 1, 2001, ISSN 1360 – 1431.

# AUTOMATED WORKING PLACE OF FUTURE TEACHERS OF ECONOMICS IN DISTANCE LEARNING

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**Abstract**: The proposed article explores some aspects of learning information systems and technologies (ISaT) by future teachers of economics using the distance technologies and Web 2.0 technologies which include systems of processing economic data in the form of specialized information systems and pedagogical software in the unified environment. The appropriate usage of automated working place (AWP) by future teachers of economics provides effective learning of theoretical foundations and practical skills in using specialized automated information systems in the different economic sectors.

**Keywords:** distance learning, future teachers of economics, information systems and technologies, economic data processing systems, automated working place

#### INTRODUCTION

The issue of quality of training students of economic specialties in pedagogical universities related to the information and communication technology (ICT) is especially necessary; because an ability to effectively use knowledge in the field of information systems and technology (ISaT) in economics and possession of a modern training method allows to improve the quality of learning process and productivity of the future teachers of economics.

At the basis of the formation of such professional qualities, an important place belongs to the creation, learning and effective use of automated working place (AWP) of the future teachers of economics. This will ensure the effective learning of theoretical foundations and practical skills in using of specialized automated information systems in different economic sectors, forming of skills in using of methods and means for decision-making on the basis of the data obtained through such systems (Kuzmina, Strutynska 2011).

# 1. AUTOMATED WORKING PLACE OF FUTURE TEACHERS OF ECONOMICS

#### 1.1. Analysis of the concept of "AUTOMATED WORKING PLACE"

According to the generally accepted definition, AWP is a software-hardware complex assigned to automate professional activity of the worker (user) with the focus on resolving of well-defined type of tasks that correspond to the functional orientation of his/her professional activity (Fetisov 2008).

Automated working places are classified according to the following criteria: user type, type of task, form of users work organization, functional orientation and so on. Separate classification of AWP of enterprises is shown in Figure 1:



**Figure 1. Classification of AWP of enterprises** Source: Own elaboration based on (Sytnyk 2001)

AWP of personnel management implement functions of making decisions. AWP of management personnel are designed for managers at all levels. AWP of specialists of structural departments (HR department, Accounting department, etc.) help to solve functional tasks for specialists of a specific direction. AWP of operational management are used to collect primary data directly at workplaces of controllers, dispatchers and others. AWP of technical workers are focused on conducting records and designed for secretaries, assistants, office managers, etc. AWP of researchers are appointed for employees whose work is related to the creation of new industrial-scientific elaboration and products, designing and creation of new technologies, etc. (Sytnyk 2001).

AWP, broadly defined, is a set of technical, software, advanced information systems and ICT. They are used for creating favorable conditions for performing of the employee's duties. At the same time, AWP mean to implement information and communication technologies in the different fields. AWP of the economist, AWP of
the manager, AWP of the accountant, AWP of the bank worker, etc. are used in organizational management of economic processes in accordance with the abovementioned classifications (Hisamudinov, Kovaleva 2009).

## **1.2.** Functional and supporting subsystems of APW of the future teacher of economics

We (Kuzmina, Strutynska 2011) defined the concept of AWP for students of economic specialties in pedagogical universities of full-time education (future teachers of economics). AWP of the future teachers of economics is the software and hardware complex for learning. It is designed for computer support for training of appropriate economics, informatics, and mathematics courses, etc. that indicated in the passport of the specialty or specialization.

This AWP, besides the above-mentioned components, should contain electronic learning materials (thematic plan, a set of lecture materials and laboratory tasks, means of control and self-control in the form of tests, examinations and other questions, reference materials, etc.).

For example, the purpose of creation of AWP of the future teacher of economics for the discipline "Information Systems and Technology in the Economics" is the formation of students' (of economic specialties of pedagogical universities) theoretical knowledge and practical skills in using of modern information systems and technologies in the different fields of economic activity.

We consider supporting and functional subsystems of AWP of the future teacher of economics.

Supporting subsystems of AWP correspond to the types of resources that are necessary for the AWP functioning. Functional subsystem of AWP is a relatively independent component of AWP, which is allocated according to the certain characteristics and corresponded to specific functions and objectives of the learning process.

The components of the supporting and functional subsystems of AWP of the future teachers of economics are shown in Figure 2.

For example, we defined supporting and functional subsystems of AWP of the future teachers of economics for the discipline "Information Systems and Technology in the Economics" by Kuzmina and Strutynska (2011). Distance course "Information Systems and Technology in the Economics" (http://www.moodle.ii.npu.edu.ua/course/view.php?id=25) is a component of the learning and methodical support of this course. Our pedagogical software (PS) "Financial Analysis and Optimization" for solving problems of financial analysis and optimization is a functional subsystem of corresponding AWP.



## Figure 2. Supporting and functional subsystems of AWP of the future teachers of economics

### Source: Own elaboration

Thus, we consider APW of the future teacher of economics for training support of course "Information Systems and Technology in the Economics" as:

- technical support that combines hardware complex (a computer, a modem, equipment for network communications with the server of the Institute of Informatics and with the Internet, and multimedia training means, etc.);
- distance course "Information Systems and Technology in the Economics" with the appropriate content;
- PS "Financial Analysis and Optimization";
- specialized information systems for solving of some economic problems, such as e-commerce, HR management, business management, financial modeling and business planning, installation files of which are located on the server of the Institute of Informatics.

## **1.3.** General description of the distance course *INFORMATION SYSTEMS AND TECHNOLOGY IN THE ECONOMICS*

We will describe the distance course *Information Systems and Technology in Economics* as a component of AWP of the future teacher of economics. The distance

course is elaborated in the Moodle distance learning system. It complies with the curriculum of the discipline. The purposes of the distance course creation is:

- gaining skills (by the future teachers of economics, mathematics and computer science) in using modern distance learning technologies;
- formation of skills in working with distance learning systems and the Internet services;
- development of qualities of the individual self-dependent activity of the students;
- improving of the general economic and informative culture of the students.

The distance course is constructed according to the modular approach. Its main components are:

- general information about the course (including purpose and objectives of training course, work program, schedule of training, methodical guidelines for working with the course, grading scale, recommended literature, inquiring, glossary, etc.);
- training modules that are consistent of theoretical material; practical, laboratory, and seminar works (which depend from the discipline); tasks for self-dependent work; current, thematic and modular control);
- final certification (test questions, final test control form).

Using of the distance learning course *Information Systems and Technology in the Economics* as component of AWP of the future teacher of economics provides students with the learning material to the discipline; enables organizing of their individual / self-dependent work; conducting of the current, intermediate and final test control form; empowers students concerning learning of materials, gaining practical skills and skills in using of ISaT in the different sectors of the economics; and allows to implement the blended learning, and promotes getting of competences of future teachers of economics in the field of ICT.

## **1.4.** General description of the pedagogical software *FINANCIAL ANALYSIS AND OPTIMIZATION*

PS "Financial Analysis and Optimization", which is a functional subsystem of AWP of future teachers of economics, is elaborated to support the learning course *ISaT in the Economics* and designed for solving of some financial and management objectives and optimization problems. The reasonability of elaborating of this PS is considered by Kuzmina and Strutynska (2010).

This PS is used for computer support of the training course *ISaT in the Economics* as a separate PS for performing of financial and economic calculations, solving of linear programming problems, computer modeling of economic processes and so on.

Elaborated PS is consistent of four modules (see Figure 3):

- Financial calculations;
- Depreciation ;
- The optimal tax rate ;
- Optimization of production.



Figure 3. Main modules PS Financial Analysis and Optimization Source: Own elaboration

We have elaborated PS *Financial Analysis and Optimization* built in the distance course *ISaT in the Economics* and assigned to form students' skills and abilities:

- using of modern ISaT and models that are used in the different sectors of economics;
- solving of the financial and management problems;
- using of specific software of automated solving of financial analysis and optimization tasks.

### 2. AUTOMATED WORKING PLACE OF THE FUTURE TEACHER OF ECONOMICS VIA NETWORK TECHNOLOGIES

Due to the intensive development of networking technologies, including the Internet-technologies, there is an urgent need for their use in learning. Recently, the Internet-technologies have played a key role not only in business, information and analysis, but also in education. Their active use within the training is now possible owing to the appearance and intensification of Web 2.0 (Strutynska 2011).

Web 2.0 is the second generation of network services that operate on the Internet. In contrast to the first generation of services, using of Web 2.0 enables users to work with services, create data and share data.

Web 2.0 is the network software that provides for group collaboration and activity (Balyk, Shmyger 2010). The most common services based on Web 2.0 include the following: blogs, wikis, multimedia services, geoservice, social bookmark, cloud services of Google, including Google documents, social networks, and knowledge maps.

The development of Web 2.0 contributes to their intensive use in the learning process, as it is important to teach students to efficiently use the network technologies not only in the learning process, but also in their future professional activity. For creating the AWP of the future teacher of the economics, it is also necessary to consider the use of the network technologies by the students. The networking technologies, that are part of AWP of the future teacher of economics, include:

- communication services (e-mail, video conferencing);
- knowledge maps;
- blogs;
- wikis;
- cloud services;
- geoservice;
- web-based software for processing economic data (e.g., Google spreadsheets).

Here is an example of Google Docs using during the training of the future teachers of economics.

Docs Google (http://docs.google.com) is shareware services of Google used for work with word processing, spreadsheets, forms and presentations that allow effective organizing of collaboration activities of users. Using these tools allows for allocating of documents on the Internet, simultaneous editing of files, on-line reviewing of the changes, and publishing of them on the Internet for sharing (Balyk, Shmyger 2010).

Figure 4 shows an example of solving the problem of finding the optimal tax rate by simulation modeling using Google spreadsheets, which are also used by students as alternative web-oriented software for the solution of economic problems within the course *ISaT in Economics*. Learners have access (via the distance learning course) to the letters of the spreadsheets.

The problem is to find the optimal tax rate and to justify it.

The following hypothesis is made: the budget revenues are not the highest if the tax rate is maximum, but the budget revenues are the highest if the tax rate is optimum over a particular period of time. That is, the increase of the rate of the tax revenues to the budget will first increase and then decrease (if tax rate is not optimum).

At first, the educator and learners discuss the descriptive model of this problem and make some necessary assumptions and specifications.

Further, students discuss and construct the mathematical model of this problem, i.e., they define the initial data set, independent and dependent variables, and finally, mathematical formulas that connect them.

The initial data: **TR** (%) – tax rate; **P** (%) – profitability, **InCap** (mln. uah) – initial capital; **Nper** – number of periods.

$$Inc_{i} = C_{i} * P$$

$$C_{i} = InCap, i = 0,$$

$$C_{i} = \sum_{i=0}^{Nper} Inc_{i} * (1 - TR)$$

$$B_{i} = \sum_{i=0}^{Nper} Inc_{i} * TR$$

$$B_{Nper} = \sum_{i=0}^{Nper} B_{i}$$

Inc<sub>i</sub> – profit of enterprise for the i-th time;

C<sub>i</sub> – capital of enterprise, that remains after tax;

 $\mathbf{B}_{i}$  – tax revenue for the i-th time;

 $B_{Nper}$  – revenues to the budget for the Nper period.

The following is needed: 1) to find the value  $Inc_i$ ,  $C_i$ ,  $B_i$  for the i-th period and the final budget revenues  $B_{Nper}$ ; 2) to test the abovementioned hypothesis by establishing of the different tax rates and the value of profitability.

Students can quickly receive and analyze the results of solving of this problem for the different values of the tax rates, initial capital and the number of periods by implementing of mathematical model by way of Google spreadsheets for the specific initial data. The research results are analyzed by means of the numerical and graphical presentation.

Appropriate tables and graphs build on the results of calculations when revenue is dependent on the value of the tax rate, taking into account the different levels of profitability. Figure 4 shows some results of these calculations.

Optimal tax rate         Файл       Редагувати       Вигляд       Вставити       Формат       Дані       Інструменти       Довідка       Усі зміни збл         Файл       Редагувати       Вигляд       Вставити       Формат       Дані       Інструменти       Довідка       Усі зміни збл         Файл       Редагувати       Вигляд       В сала       В       С       D       E       F       G       H         fx       1836       13       В       С       D       E       F       G       H         1       tax rate =       80%       2       3       4       6       6         2       profitability =       120 %       3       4       6       6         3       number of periods =       3       4       6       6       6       6         4       9       100       124       154       191       236       293       364         7       income / year       0       120       144       185       229       284       352       8         8       income - remainder / year       0       244       30       37       46       57       70 <th>ITThlUTJyW</th> <th>dHJ2OWd</th> <th>× IddNrcJ</th> <th>I tax rate =0AoZEr</th> <th>⊞ Optima t/ccc?ke</th> <th>readshee</th> <th>e.com/sp</th> <th>CITE - Go .google</th> <th>https://docs.</th> <th>265) Входящие - 1310 -&gt; С 🕯 🔒</th> <th>€ (</th>	ITThlUTJyW	dHJ2OWd	× IddNrcJ	I tax rate =0AoZEr	⊞ Optima t/ccc?ke	readshee	e.com/sp	CITE - Go .google	https://docs.	265) Входящие - 1310 -> С 🕯 🔒	€ (
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## Figure 4. Example of using Google spreadsheets within the course *ISaT in Economics*

Source: Own elaboration

Students draw the following conclusions based on the obtained results:

1) in the case of increasing of the tax rate, first the budget revenues increases and then they decreases;

2) the definite maximum is just optimal for the budget -30 % (see Fig. 5);

3) simulation confirms and clarifies the logical model which is as follows: if today's entrepreneurs have high taxes, the business remains without development, and tomorrow the state will receive less money to the budget or will receive nothing.

Thus, AWP of the future teacher of economics for supporting of the training course "Information Systems and Technology in the Economics" can be expanded with the use of the network technologies, including the technologies based on Web 2.0. The AWP will consist of:

- hardware;
- network technologies;
- distance course "Information Systems and Technology in Economics" with the appropriate content;
- PS "Financial Analysis and Optimization";



### - specialized information systems for solving of some economic problems.

## Figure 5. Graphical presentation of the results of the research with the use of Google spreadsheets

Source: Own elaboration

### CONCLUSION

Using the above described AWP of the future teacher of economics for supporting the training course "Information Systems and Technology in Economics" provides:

- intensification of the learning process;
- development of students' knowledge of modern educational technologies;
- improving knowledge and skills in working with the distance learning systems and specialized software for economic data processing;
- formation of motivational factors for learning information systems and technologies in economics as a discipline, and for the continuous learning of new information systems and technologies in general;
- formation of the skills of self-dependent learning of new information systems and technologies for economic data processing;
- development of the competences of the future teachers of economics in the field of the information systems and technologies;
- improving the general economic and informative culture of the students.

For further research we will learn national and foreign experience in the creating and using of AWP within the training of the future teachers of economics, and supplement the AWP subsystems with modern technologies.

#### REFERENCES

- Kuzmina, N.M., & Strutynska, O.V., 2011: Features of using of the automated working place of the future teacher of economics. Labor Scientific Seminar: Information technology in the learning process, 16-23 may 2011, pp. 66-72. [In Ukrainian]
- Fetisov, V.S., 2008: Automated working place of manager. Znannia, Kyiv, 2008, p. 390. [In Ukrainian]
- Sytnyk, V.F., 2001: Fundamentals of Information Systems. KNEU, Kyiv, 2001, p. 420. [In Ukrainian]
- Hisamudinov, V.V., & Kovaleva, V.D., 2009: Automated working place of economist. INFRA-M, Moscow, 2009, p. 220. [In Russian]
- Kuzmina, N.M., & Strutynska, O.V., 2010: Methods of using learning information environment to support learning information systems and technologies of the future teachers of economics. Scientific journal of Dragomanov National Pedagogical University. Series 2: Computer-oriented Learning Systems, 8 (15), 2010, pp. 74-85. [In Ukrainian]
- Balyk, N.R., & Shmyger, G.P., 2010: Web 2.0 Technologies in Education. TNPU, Ternopil, 2010, p. 128, [In Ukrainian]
- Strutynska, O.V., 2011: Using Google Docs in learning process information systems and technologies of the future teachers of economics. Scientific journal of Volodymyr Hnatiuk Ternopil National Pedagogical University. Series "Pedagogy", 1, 2011, pp. 66-71 [In Ukrainian]

### COMPUTER TRAINING IN THE GLOBAL SOCIETY WITH INSPIRATION FROM SWARM INTELLIGENCE

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**Abstract:** This paper is centred on optimal computer training in the global society with a link to suitable course design. IT (information technology) competences create a wide range of knowledge and skills. The reason is application of diverse software. Education must respect ongoing dynamic changes. This reality requires optimal course design by auto-self structure. Swarm intelligence offers a good inspiration. Dynamic course structure is based on the evaluation of educational activities. This solution reflects student preferences (as pheromones) and supports better computer training.

Keywords: education, global society, IT competences, swarm intelligence

### INTRODUCTION

The information society places hard conditions on all human activities in all fields. These conditions are linked with requirements on quality, design, usefulness, friendliness, and immediate availability. The perception of product and service is discussed on the Internet. (Riley, 2013) There are blogs, communities, and specialized websites like Facebook, LinkedIn or Twitter. IT (Information Technology) users search for various views on a given topic with the idea to find an optimal solution. They use various software, e.g. freeware, shareware, demo, cloud resolution and standard software with licences. There is great availability of such software on the Internet, without any conditions, or via registration. A positive fact is that software is accessed for many complex issues – database systems, Business Intelligence and CRM (Customer Relationship Management) products, mobile technologies.

IT users must have good experiences with installation, configuration, optimization and default software usage. In many occasions, software installation is intuitive via a guide with a few easy questions (e.g. installation type, work directory for installation, user name, e-mail contact). Further software usage is not as easy. The IT user has to follow required rules for given fields. Database systems respect rules for data storage in database files. Business Intelligence must respect conditions for optimal warehouse creation. CRM products correctly relay information about customers with an optimal website. Mobile technologies require immediate availability. Education plays a difficult role in this IT diversity. Education must respect user preferences and IT trends.

### 1. IT COMPETENCES IN THE GLOBAL SOCIETY

IT competences are influenced by actual IT trends. There are a number of surveys, studies, analyses and a great amount of research on this topic. For example, the Gartner society predicts key trends of IT development (Analysts 2011):

• Tablets.

Tablets are small devices used for communication between managers, customers and other users. Their benefit is size and connectivity via WiFi. Well-known operating systems are Google Android, Intel/Nokia MeeGo, Samsung Bada, Apple iOS, MS Windows 8. (Brůcha 2013)

• Applications for mobile technologies.

Such applications respond to touch and voice with connectivity to information systems. There are requirements regarding on-line communication, navigation, web access, document processing and fun. (Malý, Kozel & Slabý 2008)

• Context-aware computing.

Better offers are provided with suitable information about the environment, user preferences and activities. Answers to default questions like "who?", "what?", "where?" are important for activities, and IT users want an adequate reaction based on actual context. (Khan 2006)

• Wider range of analysis.

Data analysis creates various views based on actual data with cloud support. Such resolutions support better cooperation and decision-making. The auto-self activities are supported via adaptive business intelligence. (Khan & Kalbande 2013)

• Large volumes of data.

Data volume is increasing and their processing is complicated for actual information technology. A database system must process data very quick with links to further analyses. In this situation, a good solution is given by an in-memory layer of the database system that ensures data processing in memory with quick results. (The hottest trends in databases, 2011)

• Cloud computing.

Cloud offers the IT user options to apply instance creation with a virtual server (for example: Linux, OpenSolaris, Windows) and use this server for a selected application. Such applications (in cloud) are well-known. Everyone knows Google Apps with Gmail. (Waddington, Zhang, Knight, Jensen, Downing, Ketley 2013)

IT users need various skills and knowledge for the optimal implementation of information technology. Practical IT implementation creates a press on their users. These users must adequately respond according to the current situation: to monitor needed information, to search new context, to analyze actual conditions, to communicate with other IT users, to send requested information, to record video, and many other activities with the support of IT. Education must offer students various educational documents in exceptional quality and diversity for better IT competences. The reason is necessary variability based on student preferences and skills.

### 2. VARIABILITY OF EDUCATIONAL MATERIALS

Students and teachers use educational platforms for appropriate support educational activities. Education with IT support brings more dynamics and availability. An educational platform allows a person to login into a system according to user preferences. Students consume volumes of information from a given field. An educational platform such as Moodle (Moodle 2013) supports:

• Reading default educational documents.

Students have access to default educational documents in PDF files, PowerPoint presentations and text files (like MS Word, Writer).

• Viewing images and recordings.

Students may view images and watch films like videos and simulations. These documents are user-friendly with respect to visual demonstration of the required method.

• Special activities like database, glossary and wiki.

These activities help with orientation in a topic. Students select a different method of learning with the aim to repeat important concepts, terms and definitions.

• Communication between students and teachers.

Such activities are forums, workshops and e-mail. These activities are a standard part of learning in class. E-learning also needs these activities for better specification, clarification and detailed descriptions. Communication also enables a person to share impressions from learning and first insights.

• Feedback via tests, surveys and explorations.

Test activities bring a necessary degree of learning control. Students and teachers see actual results based on answers. Feedback is important with respect to stress on adequate skills and knowledge. Students must discern their current abilities that they offer in practice. Teachers must know about their actual results in the form of transmitted knowledge to students.

• Special educational activities like lessons.

This activity helps with orientation in a topic. Students are introduced to needed definitions, methods and procedures. This interpretation is followed by a test section. Based on the answers, students are referred to a new lesson (if the answer is correct), or to the same lesson (if the answer is incorrect). This approach is suitable for better support of optimal knowledge and skills acquisition.

### 3. COMPUTER TRAINING WITH INSPIRATION FROM SWARM INTELLIGENCE

The above-mentioned educational activities help to define computer training with optimal course design. The teacher can easily create required activities with the use of guides or templates with default settings and items. The question is about their selection and location in the course. Optimal course design should reflect a student's perception. Students compose a mosaic of knowledge and skills of their own experience from education and practice. Some students prefer videos, simulations and communication via a forum. Some students better understand a topic based on reading documents with a discussion to follow. Some students prefer the method of testing with ad-hoc answers. Some students need a challenge in the form of a complex task for individual problem-solving. And of course, some students like to solve tasks in groups with interactive communication.

The students' spectrum of priorities is diverse, and education has a difficult role in order to conform to all student priorities and needs. This situation complicates dynamic changes in student preferences and societal needs. Teachers may estimate suitable course design based on cooperation with students. The other method is inspiration from nature. There is a specialized field that is focused on swarm intelligence. (Hazem & Janice 2012) Swarm Intelligence is used for simulating the collective behaviour of swarms. These swarms create social colonies in nature (ants, bees and birds). The unique benefit is visible in seeking a suitable resolution. These swarms create individuals with limited capabilities, but the swarms find the optimal solution based on cooperating on the task needed for survival. (Lim, Jain & Dehuri 2009)

The global information society needs cooperation for gaining the optimal solution from existing tasks, obligations and problems. The countries of the EU (European Union) face economic hardships such as low economic growth and high unemployment (Walker 2013) with links to violence and discrimination. For active resolution in urgent tasks, people need cooperation, communication, good orientation in the topic based on suitable skills and knowledge. These capabilities must be improved. Necessary improvement brings education with practice, and nature brings inspiration into practice and education. Swarm intelligence is practically applied in many areas (bioinformatics, business, data mining, dynamical systems, finance, finding optimal routes, image analysis, machine learning, medical informatics, scheduling, structural optimization). (Hazem & Janice 2012; Udgata 2010)

The presented idea is inspired from swarm intelligence that is applied in education. Based on the Ant Colony Optimization Model (Keller & Gordon 2009; Chan & Tiwari 2007), optimal course design is defined with links to educational activities. This model describes the behaviour of ants on their way for food. Some ants found the shortest path to the food. They mark this way with pheromone and this path is more attractive for other ants. These ants follow this marked path. Please see Figure 1.



Figure 1. Ants' stigmergic behaviour in finding the shortest route between food and nest

Source: Dorigo & Stützle, 2010

In parallel view, educational activities are understood as a path to knowledge and skills. The question is about their optimal composition in a course (optimal path). Students and teachers are individuals in the class (virtual or default swarm). In nature, the ant swarm found the optimal resolution to the task via pheromones. The class (swarm) of students and teachers also seeks an optimal resolution to the task using student preferences and practice. These preferences make pheromones; therefore, actual use of educational activities must continuously be monitored. Good experience brings monitoring through log files. Monitored preferences suggest better course composition. Based on obtained information, teachers create an optimal course design or lecture structure. Please see Figure 2.

The preferred educational activities will be used in the main part of course; other activities (with small preference) will be placed in an additional section of the course (in the final part). For easy implementation, evaluation of educational activities must

be marked with a preference value (for example, a range from one to five like grades in school), and the order of educational activities is given a mark from the lowest to the highest mark. The optimal path to knowledge and skills is defined with the preferred course design based on auto-self order of educational activities via preference evaluation.





Source: Own

### CONCLUSION

The global society is exposed to pressure on realized activities. Challenging requests exist for the optimal offer of products and services. Information technology helps with information distribution in society. There is various software to support needed activities based on complex issues. IT users must apply such software based on knowledge and skills. The range of needed knowledge and skills corresponds to software variability. Suitable IT competences bring education and practice. Education must respect the diversity in student preferences and practice with the support of an educational platform. For example, Moodle offers activities like documents, images, videos, simulations and special activities as database, forum, glossary, lesson, test, wiki, or workshop. Optimal computer training influences course design. By default, teachers create courses based on manual creation of needed activities. For dynamic changes, dynamic course design is required by autoself course structure. This solution is inspired by swarm intelligence and preference evaluation of created activities by students. The aim is to find the optimal path to knowledge and skills for better computer training.

### REFERENCES

- Analysts: Top Trends in IT for 2012 and beyond, available at http://www.businessit.cz/cz/analytici-hlavni-trendy-it-2012-big-data-servery-tablety.php, (accessed on December 2011)
- Brůcha, F., 2013: Samsung preparing tablet with two operating systems, available at http://computerworld.cz/hardware/samsung-chysta-tablet-s-dvema-operacnimi-systemy-50083, (accessed on June 2013)
- Riley, G., 2013: Marshall Society Essay Competition for 2013, available at http://www.tutor2u.net/blog/index.php/economics/comments /marshall-society-essay-competition-for-2013, (accessed on July 2013)
- Dorigo, M., Stützle, T., 2010: Ant Colony Optimization: Overview and Recent Advances. In M. Gendreau and Y. Potvin (eds.), Handbook of Metaheuristics, 2nd edition, International Series in Operations Research & Management Science, Springer Verlag, New York, Vol. 146, pp. 227-263.
- Hazem, A., Janice, G., 2012: Swarm Intelligence: Concepts, Models and Applications, School of Computing Queen's University Kingston, Ontario, Canada, available at http://research.cs.queensu.ca/TechReports /Reports/2012-585.pdf, (accessed on February 2012)
- Chan, F. T., Tiwari, M. K. (eds.), 2007: Swarm Intelligence: Focus on Ant and Particle Swarm Optimization, I-Tech Education and Publishing, Vienna, Austria.
- Keller, L., Gordon, E., 2009: The Lives of Ants, Oxford University Press, Oxford.
- Khan, S., Kalbande, D. R., 2013: Adaptive Business Intelligence model for Cross Functional Integration for Manufacturing Industry, International Journal of Computer Applications 2013, pp. 7-11, ISSN: 0975-8887
- Khan, O., 2006: Context and Context-Aware Computing, CS260, Fall 2006.
- Lim, C. P., Jain, L. C., Dehuri, S., 2009: Innovations in Swarm Intelligence: Studies in Computational Intelligence, Vol. 248, Springer.
- Malý, F., Kozel, T., Slabý, A., 2008: *Mobile approach, trends and technologies in modern information system*. Proceedings of the 7th WSEAS International Conference on Applied Computer & Applied Computational Science, Hangzhou, China, ISSN: 1790-5117

Moodle, http://moodle.cz, (accessed on August 2013)

The hottest trends in databases, available at http://www.businessit.cz/cz

/nejzhavejsi-trendy-databaze-in-memory-cloud.php, (accessed on August 2011)

- Udgata, S. K., 2010: Swarm Intelligence A Tool for Optimization in various Information Technology Applications, The 4th Mahasarakham International Workshop on Artificial Intelligence, Mahasarakham University, Thailand.
- Waddington, S., Zhang, J., Knight, G., Jensen, J., Downing, R., Ketley, Ch., 2013: *Cloud repositories for research data – addressing the needs of researchers*, Journal of Cloud Computing: Advances (SpringerOpen Journal), Systems and Applications.
- Walker, A., 2013: Eurozone unemployment reaches new high, News Business, available at http://www.bbc.co.uk/news/business-20943292, (accessed on January 2013)

## SOME EXAMPLES OF USING E-LEARNING FOR IMPROVING STUDENTS' KEY COMPETENCIES IN INITIAL TEACHER TRAINING (ITT)

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**Abstract:** In this paper we would like to achieve a better understanding of approaches to students' competencies and curriculum requirements in initial teacher training at Zilina University. We would use this information to evaluate competencies and students' skills with introducing information and communication technology via an e-learning platform, LMS Moodle. Some results of this paper would identify and share some examples of good and effective practices.

**Keywords:** e-learning, students' competencies, information competencies, information education, information and communication technologies

### INTRODUCTION

According to Zacharová and Bomba (2011: 216) the school loses its monopoly on information. As the traditional role of teacher is changing, the way of education is also changing and this happens just under the influence of penetration of ICT. Education is starting to move away from the traditional way which was the specific location, time, age, and class-clock system etc. So this method is becoming obsolete and is gradually replaced for example by e-learning.

We can say that terms such as information and communication technology (ICT), elearning, virtual environment and online learning is now a standard part of the dictionary, not only in professional educational environments, but often used in the dictionary of pupils in low secondary education. Also, the facilities of ICT are an important part of the terms of the educational technology. For many authors, this educational discipline is perceived as "more progressive and the younger sister of the theory of instruction". According to Průcha (2006) we need to identify and summarize all the pedagogical aspects of applied and used ICT tools. Therefore, the educational technology should not be seen only as a guideline for the application of ICT into teaching and learning.

Many authors have subscribed to the most current issue of applying new educational strategies - it is the question of evaluation of the impact of ICT on methods of learning, teaching, learning styles of students, the teaching style of the teacher, the quality of education, and the competencies of students and teachers. Certainly the educators have an active role to identify and develop students' information competences regarding their ability to find, define context, and create a non-linear relationship with this mass of information. It seems that this would be a good way to integrate modern technologies and utilize the traditional educational environments currently existing in our schools. The roles as well as the types of activities are changing. According to the Association for Educational Communications and Technology, the information literate student has basic skills to work with the computer as a didactic teaching tool, but computer literate students are not necessarily information - competent. Interesting question states Zacharová (2011). She asks: "Do teachers accept this situation in general or is there only a small group of enthusiasts, "e-teachers" who can accept it? According to Trabalíková (2012) we stress that if our schools are supposed to face innovations, they should be systemic and premeditated; they should be intermingled with all the teaching subjects. From our personal experience we know, that for students just the lack of information literacy devalue cognitive processes and learning outcomes themselves as computer literacy.

### 1. DEFINITION OF THE CORE TERMS

As we mentioned in the introduction, the area of development of the capabilities to search relevant information and to work with them effectively, to learn the methods of their processing and applications become key to change the paradigm of education. In this respect, the professional field meets terms of information and media literacy, meaning all skills needed for life in the information society. We mean the ability to search, evaluate and use information from various sources and also a disposition to work with various forms of media (text, images, animation, movies, etc.) as carriers of information (Smith 2003). In general, the information literate person is able to:

- use the opportunities of the information society,
- obtain the necessary information, which is essential for solving problems and for making the right decisions,
- identify potential sources of information,
- improve the strategies for seeking information in book and electronic form,
- disclose information using information and communication technologies,

- evaluate information and organize it systematically for application in specific situations,
- integrate new information into conceptual structures,
- form special, individual style in effective interaction with the world of information (cited by the American Library Association).

According to Müllers (2001) it is the way the learner processes, analyzes and selects the information part of the innate cognitive style, in which he/she explores the world and acquires the access to the results of human cognition and interconnection of information resources. Fig. 1 indicates the degree of suggestibility of components of student learning styles, which include the above mentioned cognitive style, the process of information processing, social and emotional processes, entering "into play" in teaching and learning for scholars, and last but not least, there are also instructional pupils' preferences.



Figure 1. Schematic folders learning styles of pupils/students, which is a way of processing information given as one of the partly influenced factors, which is based on cognitive style

Source: Own elaboration based on: Mareš, 1998 in Müller, 2001: 52

As the author states, in the figure is shown very clear that the deepest layer (congenital basis, personal cognitive style of the pupil) is the most stable, and very difficult influenced by external influences. The layer comprising the processes by which a student processes information is based on cognitive style, but is only partly influenced by external interventions - through submitted new information is the student encouraged to their processing and acquisition. Another layer comprising social, motivational and emotional processes is more susceptible to external conditions (teachers, parents and educators or life situations). Student preferences are viewed as processes, methods and forms that the student prefers the most in the learning and the teaching process, which suits him/her the best. According to this scheme these are influenced by the educational action of the teacher. We believe that by changing the paradigm of education the scope for influencing the information processing strategy is shown to be much greater than is stated in Figure 1. As stated by Kosová (2002: 6) the major teacher role in today's information society becomes: "a diagnostic role, facilitator and guide of the development of each pupil or effective teaching situations manager, reflective professional and innovator, creator of the stimulating and emotionally safe class-or group- climate. Vančíková (2011: 162) in this spirit, very aptly quotes the words of Professor Umberto Eco, whose article on what is the meaning of the teaching profession nowadays and what are its key tasks write, " a student provoked his teacher with the following question: "Sorry, why are you here, when we have the Internet ...?" The response to the student was an interesting teacher's observation: "student gave only half of the truth, because the teacher has to inform but also form simultaneously."

Furthermore, the student also stated, that information from the Internet is the "great mother of all encyclopedias," and are much broader and often deeper than those controlled by the teacher, but he forgot one thing: The internet tells him "almost everything", but does not tell him how to search, filter, select, accept and reject information. Therefore, anyone can gather new information, just good memory is needed. But to decide which ones are worth remembering and which are not, is an art ... The teacher should also serve as an example of someone who is trying to give individual knowledge into systematic relationships (Eco 2007 in Vančíková 2011: 162-163). The following perceived conception and integration of educational and didactic aspects of e-learning in the context of education is often present in the literature by using the term "Information Education".

The terminological lexicon of new information - communication technologies and their implementations (Katuščák 1998) the term is defined as "a comprehensive systematic formative process of acquiring skills and knowledge from fields and disciplines dealing with the collection, processing, storage, disclosure and use of various types of professional information and resources." In a broader definition of informational education we understand it as the implementation of "rational education and training of the human for the use and creation of knowledge in order to acquire a comprehensive system of knowledge, skills and habits in the cognitive process." Information education as a process leading to a targeted and deliberate processing and efficient use of information is very current concept in today's information society. Sakalová (1998) understands information education as an integral component of the educational process, which is aimed at creating adequate

models of information behavior of pupils and students. According to Horváth and Švejda (2006) information education doesn't accept only control of the information and communication technologies. Its major objective is to contribute, together with other subjects to the development of pupils' and students' as well as adults' cognitive skills in lifelong learning system. Actually, the work with information itself such claims Chupáč (2007) is one of the creative methods of teaching process – it learns autonomy, analytical thinking, concentration, attention and "in-depth learning style". Also, in the creative - humanistic conception of education (KEMSAK) one of the strategies leading to the cognitivism of personality is the method of working with information funds, which, as claims Zelina (1996) should teach student to collect, store, systematize and share information and lead him to create his own information system, linked to various information sources (electronic, library, etc.).

### 2. SUPPORT OF INFORMATION COMPETENCIES IN THE FRAMEWORK OF CURRICULUM CONTENT FOR SELECTED LEVELS OF EDUCATION

In the Slovak Republic after 2008, we adopted a two-tiered National educational curriculum, which consists of a framework of state educational program and is applied to the specific schools through school educational programs. For all levels of education within the learner graduate profile there are defined and classified competencies which become a part of the educational model of education graduate level. Classification and characterization of core pupils' competencies is adjusted according to the recommendations of the European Parliament and the Council from 2006 about key competences for lifelong learning. Already in pre-primary education, information competences are a natural part of child core competency models. This set of competencies serves for teachers to know where to direct their educational activities through purposeful, meaningful development, appropriate to the children. Due to the fact that learners gain specific capabilities, especially fundamental change in both the content and educational strategies is desirable. The national curriculum (ISCED 0, Ministry of Education, 2008/2009), information competencies defined in this spirit:

- child manifests the pleasure from self-obtained information,
- use different sources for obtaining and collecting information beyond kindergarten (from people in the environment, from childrens' books, magazines and encyclopedias, through information and communication technologies, from various media).

From our own experience as university teachers we can confirm that many university students have limited ability to find the required special information, process them, or by selection determine their importance and to interpret this information in appropriate ways. Their low level of information - communication competencies is also reflected in the findings, that many students can pass the required 5-6 pages of continuous scientific text, i.e. information obtained in the field, but they can not explain, reproduce, prepare hierarchical structure of important and less important information, ask questions on the subject, work with graphs and diagrams, etc.. Empirical experiences of Sakalová and Matthaeidesová (1999) confirmed that many of the current high school graduates who are seeking a university education, do not know the basics of self-study methodology, do not know to make notes, to work with text, do not know how to excerpt, quote, do not create the need for tasks information security, do not know the practice of creating the professional expression, and do not know to organize personal information.

It follows that the contents of undergraduate educational teacher training should not be acquiring skills only for computing and information and communication technologies (promotion of computer literacy), but mainly to effectively work with information in book or electronic form. This area should be an essential part of a teacher's preparation of professional standards, respectively the process of professionalization of teacher education. This is why we try to develop the ability to search, evaluate and use information from various sources with students of teaching study programs to the Faculty of Humanities, University of Zilina from the beginning of their university study in many subjects. This would then become part of the information education of students in initiating teacher education.

#### 3. SELECTED ASPECTS OF THE SUPPORT OF THE **COMPETENCIES INFORMATION** AND **INFORMATION** EDUCATION OF **STUDENTS** OF TEACHING STUDY PROGRAMS AT THE FACULTY OF HUMANITIES, ZU

## **3.1** Implementation of forms of e-learning vs. blended-learning in tertiary education

According to Zounek (2006: 338) there is no clear definition of a direct understanding of the concept of e-learning. Maybe it is why we note the differences not only between authors, but also in interpretations between countries. For example, in the U.S.A, the concept of e-learning overlaps with a broader term "technology-based training "(technology-assisted learning). So e-learning is seen here as a wide set of the most advanced ICT and also "traditional" technologies (computers, virtual classrooms, radio, TV, websites)" . The European definition is different, more precisely focuses on the modern technology, for example the European Commission (www.elearningeuropa.com) defines e-learning as "the use of modern multimedia technologies and the Internet to improve the quality of education, in particular by facilitating access to resources, services, information exchange and distant cooperation." We agree with the author mentioned above who defines e-learning as "any learning process with varying degrees of intentionality, in which ICT are used when working with data in electronic forms. The method of use of ICT is dependent primarily on educational objectives and content, the nature of

the learning environment, needs and opportunities of all factors of the educational process." (Zounek 2006: 340). According to Singh (2003: 52) application of elearning forms has gone through two stages in recent years. The first meant digitization of traditional "classroom-based courses" to the environment of the Internet and forms of online learning. Experience has shown many advantages and disadvantages. E-learning education and study provided on-line disclosure of information, communication, and more attractive learning processes, checked the progress of the educational process through online tests, supported the possibility of individual learning and finally developed information, computer and media competencies of students and teachers. On the other hand, it supported the lack of social contacts and interactions, often in the literature described as "being lost" in the oversized information content and irrelevant information. Rapidly emerging field of study which started in the late 1980s is Computer-supported collaborative learning (CSCL). Arranging students to work collaboratively at the computer reaps the benefits both of the use of computer simulation as an exploratory tool and of peer collaboration (Tao, Gunstone 1999: 43). In the second wave of e-learning many teachers, tutors, and educators began experimenting with interesting and even promising alternatives in ICT-assisted learning with "blended learning". It is sort of "hybrid learning" (Zounek 2006: 340), which links the present forms of teaching with e-learning. Thus, according to Singh (2003: 53) blended learning is a combination of: a) face-to-face teaching (contact, full-time course) with traditional teaching instructions, b) asynchronous teaching (off-line teaching) different forms of student self-study or participants in training courses and modules, c) practical training of sensomotoric skills (especially in professional education). Hrušecký (2005) characterizes the on-line education and "blended" learning by using an approximate quantification of the course content.

The Department of Educational Studies, Faculty of Humanities, University of Žilina in undergraduate (initiating) teaching programs provides guidelines for the education roles and the obligation to convey the curriculum to students clearly, interestingly and attractively. It is the combination of the presence of traditional and electronic forms of study via LMS Moodle (Learning Management System), which support us in those efforts. Our experience with these forms of education are based on a number of methodological assumptions for creating e-learning materials. Like stated by Drozdová (2007) didactic support for the development of students' information and media competencies in computer-assisted instruction should be well designed study material in an interactive, preferably multimedia electronic form. When applying forms of "blended learning" in undergraduate education it was based on the following methodological principles:

**3.1.1 The contents of study materials and image processing** - clarity, accuracy, technical terms actuality, understandable clarification and disclosure of new concepts. Not insignificant is gradation of awarded tasks and activities difficulty. We also respect the fact that scientism and professionalism of teaching material presented in the e-form is not directly related to the disproportionate number of

specialized words and the complexity of expressive language. Teaching material available to our students in an electronic learning environment contains definitions of the key concepts of certain teaching subject, classification from different perspectives and serves the basic orientation in the topic. It is a support and working material for students. Students can make additional notes in it, put illustrative examples, diagrams and links to further literature on the lecture (during contact teaching). Thus, during the contact (presence, face-to-face) more focus can be placed on the actual interpretation of the university teachers and the specifics of the issue presented, and can perceive more details if needed. Within the graphic design of study materials we focus on an efficient linking of hyperlinks, adequate font size, variety of colours in the academic text (examples, summaries, links to key and new concepts), appropriate integration of suitable plans, diagrams, etc.

**3.1.2 Interactivity and obtaining feedback on work with the electronic system of education** - to achieve effective communication it is necessary that study materials in electronic form should contain enough interactive elements. After ensuring this condition, the student is not in the role of a passive observer. The most value is when the material provides effective feedback and students are encouraged to other activities by this feedback (e.g., use a dictionary of basic concepts, manual, links to other print and electronic resources, contacts, forum, etc.). To provide questionnaires for students continuously is also beneficial. We obtain feedback on practices and forms of e-learning. We have chosen a few sample questions from the formative evaluation questionnaire for the purpose of this paper:

1. How do you work with a virtual learning environment LMS Moodle.

2. If you see the positives in the study with LMS Moodle, which are they?

3. If you see the negatives in the study with LMS Moodle, which are they?

**3.1.3 Application of other aspects of teaching in blended learning** - after several years of experience as university teachers, we find that through blended learning the following options and elements can be applied:

a) Fostering the creativity and independence of students (especially for future teachers their development is a part of their future professional competencies)

b) The presence of feedback tasks that constantly give students the answer, if they follow when learning properly and thus achieve a predetermined teaching goal

c) Flexibility and complexity in the processing of assigned tasks and issues with the use of multiple sources of information, visual and graphic aspects

d) The diversity and uniqueness of the sources of knowledge

e) Teaching in blended learning and e-learning is a less dominant source of information, but rather a guide in building adequate conceptual structures within the taught topic subject.

In this sense we try not only to explain to students, but also practically lead in the use of conceptual mapping methods.

Finally, students are encouraged to use a wide variety of sources and materials, but also are led to learn how to evaluate and compare the quality and reliability of sources, which is an advantage especially in development of critical thinking. Based on our own teaching experience, we consider this a control and summative or formative evaluation of the course results, which is based on face-to-face communication between students and teachers.

### Table 1.

### An example of activating task from the instructional material for supporting students of teachers' program information competencies in the initiating stage of education

Task	
Situation:	

At the beginning of their teaching practice teachers may encounter the situation where the appropriate workbook for this subject is not available. In other words, there is no "support teaching material" which pupils/students need to work with. How you can solve this situation?

Your task:

Please prepare a suitable teaching material, one chapter of a textbook (at least 4 pages, title page is not counted, the line spacing 1.5 and standard page margins) for chosen age group (any grade at primary or secondary school) for your teaching subject. Try to maintain the methodological principles of clarity of the information presented, the adequacy of the terms and its explanation for a selected group of students.

Use:

- A suitable topic for study material and choose a grade of primary or secondary school to which the material will be directed;

Selection of an appropriate text and images from the Internet;

- How to differentiate colours according to the relevance of the information (to distinguish important from less important terms) create an appropriate structure of the text according to cognitive abilities of students, and of course, use headings and subheadings;

- The toolbar with drawing or sketchbook to create diagrams;

- Form of columns, tables, framing the text;

- Modify the cover page of teaching material (use header and numbers of pages);

- At the end of the study material devise tasks (questions) to identify the level of knowledge gained from the teaching material created by you.

Source: Own elaboration: Kubalíková 2007

### CONCLUSION

This article deals with clarifying e-learning, blended-learning and information education as an integral component of the educational process, which is aimed at creating adequate models of information behavior of students via an e-learning platform LMS Moodle. It deals with didactic aspects of the use of ICT in the educational environment, not only at the level of the guideline for application of ICT into teaching and learning, but also with the aim to progressively systematize these aspects. It is based on the pedagogical principles of teaching and learning which should be respected in design of e-content. Also this method can support the development of university students' abilities to analyze, sort, select, interconnect and integrate information with an emphasis on developing their information competence. This indicates that currently when teaching university students, it is possible to seek and find sufficient space for influencing the way and strategies of information processing through the implementation of information and communication technologies.

### REFERENCES

- Drozdová, M., 2007: *Where We are and where We are Heading in the E-learning.* In E-learn 2007, Žilina: EDIS, 2007, pp.105-111, ISBN: 978-80-8070-645-6.
- Horváthová, Z., Švejda, G., 2006: The Necessity of Introducing Information Literacy into Education. In Schola 2006. Bratislava: Slovak University of Technology, 2006, pp. 115 – 119, ISBN: 80-227-2389-4
- Hrušecký, R., 2005: Materials for E-learning. In Poškole National Conference on Computers at School. Liberec: International Organizing Committee POŠKOLE, 2005, pp. 203-206, ISBN: 80-239-4633-1
- Chupáč, A., 2007: *To the Methods of Creative Teaching in Primary Schools*. In Journal for Schools and Educational Institutions, Banská Bystrica: Methodology-pedagogical Centre, 2007, vol. 16, no. 4. ISSN: 1335-0404
- Katuščák, D., 1998: Information Literacy: Terminological and Explanatory Dictionary. Bratislava: Slovak Pedagogical Publishing House, 1998, p. 375. ISBN: 80-08-02818-1
- Kosová, B., 2002: *Lifelong Learning and School Education*. In Journal for Schools and Educational Institutions, Banská Bystrica: Methodology-pedagogical Centre, vol. 11, no. 4. ISSN: 1335-0404
- Kubalíková A., 2007: Experiences in creating educational materials for electronic learning. In: E-learn, Žilina: EDIS, 2007, pp. 163-166, ISBN: 978-80-8070-645-6

- Műllerová, L., 2001: *Learning Styles of Students*. In Acta Facultatis Paedagogicae Universitatis Tyrnaviensis, series D: Science Education and Training, Trnava: Trnava university, 2001, No. 5, pp. 51-58, ISBN: 80-89074-12-X
- Nine Information Literacy Standards for Student Learning. 2003 [online]. National Forum on Information Literacy, available at http://www.infolit.org/definitions/9standards.htm, (accessed on 29 April 2003)
- Průcha, J., 2006: Teaching Science and new Challenges for Educational Practice. In Education – New Technologies and New Forms in Education, 2006, no. 4, pp. 307-315, ISSN: 0031-3815
- Sakálová, E., Matthaeidesová, M., 1999: Work with Information in Teaching at Primary and Secondary Schools. In: School Libraries, 1999, p. 127.
- Sakálová, E., 1998: Theoretical Problems of Information Education. In Library and Information Science XVII. Bratislava: Faculty of Philosophy, Comenius University in Bratislava, 1998, pp. 79-93. ISBN: 80-223-1236-3
- Singh, H., 2003: *Building Effective Blended Learning Programs*. In Issue of Education, 2003, vol. 43, no. 6, pp. 51-54.
- Smith, 2003: Information Literacy Competency Standards for Higher Education. 2003 [online]. American Library Association, available at http://www.ala.org/acrl/ilcomstan.html (accessed on 29 April 2009)
- State education program, available at http://www.statpedu.sk/sk/Statnyvzdelavaci-program.alej, (accessed on 15 June 2013)
- Tao, P., K., Gunstone, R., F., 1999: Conceptual Change in Science through Collaborative Learning at the Computer. In: International Journal of Science Education. vol. 21, no. 1, pp. 39-57. ISSN
- Trabalíková, J., 2012: Action Plan of a Teacher in His/Her Own Class. In: e-Pedagogium, 2012, no. 2, pp. 71-94. ISSN 1213-7758.
- Vančíková, K., 2011: *The Teacher*. In: School and Society. Banská Bystrica: UMB, 2011, p. 168, ISBN: 978-80-557-0184-4
- Zelina, M., 1996: Strategies and Methods of Developing the Child's Personality. Bratislava: IRIS, 1996, p. 230: ISBN 80-967013-4-7
- Zacharová, J., Bomba, L., 2012: Advantages and disadvantages of e-learning in university education. In E-learning for Societal Needs, Monograph, Sc. Ed. E. Smyrnova-Trybulska, University of Silesia, Katowice-Cieszyn, pp. 215-227, ISBN 978-83-60071-59-5
- Zacharová, J. 2011: Pedagogical didactic aspects of E-learning. In Use of E-learning in the Developing of the Key Competences, Monograph, Sc. Ed. E.Smyrnova-Trybulska, University of Silesia, Katowice-Cieszyn, pp. 153-166: ISBN: 978-83-60071-59-5

Zounek, J., 2006: *E-learning and education – Several views on the issues of E-learning.* In Education – New Technologies and New Forms in Education, 2006, no.4, pp. 335-347, ISSN: 0031-3815

### DESIGNING AND PROGRAMMING ROBOTS IN CONTEMPORARY DIDACTICS IN POLISH SCHOOLS

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**Abstract:** The article presents a solid fastening for educational classes – conducted with the use of sets for building and programming robots – in the European reference framework, in the context of educating key competences. It indicates these contents of applied Polish core curriculum (school curriculum of general education) which might be carried out by the participation of students in the suggested classes with robots. It presents the method of working with sets for building and programming robots which was tested during classes with students of Polish primary and lower-secondary schools.

**Keywords:** key competences, curriculum, LEGO MINDSTORMS NXT robots, EduRoboLab method, constructionism, social networking sites, technical education

### **INTRODUCTION**

In order to use the sets for building and programming robots in didactics we have to ask ourselves three basic questions: 'Why?', 'Where?' and 'How to do it?'.

In the first part of the article the author describes the anchoring of educational classes – conducted with the use of robots – in the European reference framework, in the context of educating key competences. This is the answer to the question: 'Why?'

The second chapter indicates the place of carrying out classes with robots (the subjects and the contents of educating), with the currently applied in Poland core curriculum. This is the answer to the question: 'Where?'

The third chapter was created on the basis of the author's own educational experiences. The method of working with sets for building and programming robots which was described here was tested during the work with students of primary and lower-secondary schools. This is the answer to the question: 'How?'.

The contents described in this article might help professionally active teachers independently of what sets for building and programming robots they use in their

work. Nevertheless, the author works with sets of MINDSTORMS NXT 2.0 by LEGO everyday.

The registered trademarks were used in order to identify the products and they belong together with the copyrights to their owners.

### 1. ROBOTS AND TEACHING KEY COMPETENCES

In the attachment *Key competences for lifelong learning – European reference framework* to the Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, key competences are defined as a combination of knowledge, skills and attitudes appropriate to the context.

Key competences are those which all individuals need for personal fulfilment and development, active citizenship, social inclusion and employment. (KC 2006: 13)

The Reference Framework sets out 8 key competences:

- 1. communication in the mother tongue,
- 2. communication in foreign languages,
- 3. mathematical competence and basic competences in science and technology,
- 4. digital competence,
- 5. learning to learn,
- 6. social and civic competences,
- 7. sense of initiative, entrepreneurship,
- 8. cultural awareness and expression. (KC 2006: 13)

Due to the title of the article it is vital to analyse the mathematical competence, basic competences in science and technology and digital competence. The point of reference might also be the anticipated social competences of students.

The attachment to the Recommendation of the European Parliament, which was mentioned above, presents a range of **mathematical competence** as the one that includes the ability to develop and apply mathematical thinking in order to solve a range of problems in everyday situations. The emphasis here is on process and activity, as well as knowledge. Mathematical competence also involves – to different degrees – the ability and willingness to use mathematical modes of thought (logical and spacial thinking) and presentation (formulas, models, constructs, graphs, charts). (KC 2006: 15)

The attention is drawn to the emphasis of applying mathematical competence in the context of solving problems in everyday situations. How, in the same context, science and technology competences were defined in the cited document?

**Competence in science** refers to the ability and willingness to use the body of knowledge and methodology employed to explain the natural world, in order to identify questions and to draw evidence-based conclusions. **Competence in technology** is viewed as the application of that knowledge and methodology in response to perceived human wants or needs. (KC 2006: 15)

And again the attention is drawn to the emphasis of the application of knowledge and methodology employed in response to perceived human needs. According to the authors of the document it is necessary to aim to be able to reason mathematically and communicate in mathematical language.

A positive attitude in mathematics based on the respect of truth and the willingness to look for reasons and to assess their validity was mentioned in the document. Competences in science and technology include an attitude of critical appreciation and curiosity, an interest in ethical issues and respect for both safety and sustainability, in particular as regards scientific and technological progress. (KC 2006, p. 15)

The added value of the educational process connected with ethics, culture and respect of work and studies is supposed to be reflected in the students' attitudes.

**Digital competence** involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication.

It is underpinned by basic skills of information and communication technology (ICT): the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet. (KC 2006: 15)

Digital competence requires a sound understanding and knowledge of the nature, role and opportunities of IST in everyday contexts: in personal and social life as well as at work. Students are supposed to be able to use IST to support critical thinking, creativity and innovation. Use of IST requires a critical and reflective attitude towards available information and in a responsible use of the interactive media. (KC 2006: 16)

It seems that the creativity and the innovation mentioned above should also be seen in forming new tools ICT. This is the appropriate place for the work of equipment and software specialists: people who are above average competent in the field of computers.

**Social competences** include personal, interpersonal and intercultural competence and cover all forms of behaviour that equip individuals to participate in an effective and constructive way in social and working life, and particularly in increasingly diverse societies, and to resolve conflict where necessary. (KC 2006: 16)

For successful interpersonal contacts and social participation it is essential to understand the codes of conduct and manner generally accepted in different societies and environments (e.g. at work). The core skills of this competence include: the ability to communicate constructively in various environments, express and understand different viewpoints and the ability to negotiate (creating the atmosphere of trust). The competence is based on an attitude of cooperation, assertiveness and integrity. (KC 2006: 17)

It seems that in the nearest future in our society there must be a transition towards the development of interpersonal relations and building a social capital of groups, firms, organizations and the society. These relations should be built on interpersonal trust. It will not take place without a significant increase of the quality of communication inside the mentioned communities. Teaching social competence in this context appears to be crucial.

Key competences (Figure 1) which were chosen and presented in this study were reflected in the documents describing education in Polish schools, particularly from 2009/2010 when the new core curriculum was first introduced.



Figure 1. Robots in education and teaching key competences Source: Author's own coverage

In the following part the author describes Polish regulations concerning children and youth in primary and lower-secondary schools, in the context of educating competences by the suggested classes with robots.

# 2. ROBOTS AND THE POLISH CORE CURRICULUM OF GENERAL EDUCATION

The proposed workshops during which sets for building and programming robots are offered, are supposed to develop students' abilities described in the core curriculum for primary and lower-secondary schools (Table 1).

### Table 1.

Area	Curriculum for primary schools (CC 2012a: 9)	Curriculum for lower-secondary schools (CC 2012b: 73)
mathematical thinking	the ability to apply basic tools of mathematics in everyday life	the ability to apply basic tools of mathematics in everyday life and formulate judgements based on mathematical thinking
scientific thinking	the ability to formulate conclusions based on empirical observations	the ability to use scientific knowledge to identify and solve problems and to formulate conclusions based on empirical observations
applying tools of information- communication technology	the ability to apply modern information-communication technologies including those for searching and using information	the ability to use modern information-communication tecnologies in a skillful way, the ability to search, select and analyse information critically
teamwork	the ability to work in a team	the ability to work in a team

Skills described in the curriculum for primary and lower-secondary schools

Source: Author's own coverage

Although the phrase 'key competences' does not appear in the core curriculum, it is easy to notice that the skills being described meet the key competences introduced in the first part of the study.

In primary school after the first educational stage student is equipped in all the essential skills which are necessary for classes with robots, while designing their own machine or their own robot. After the third year of learning – based on the mentioned core curriculum – students carry out 'the way' of creating objects from the idea to the product: they are skilled to measure the right amount of material; they have skills to assemble models from plastic, use simple constructions and diagrams; they understand the need to organize technical actions – individual and team work. (CC 2012a: 23)

Moreover, these students are able to operate the computer, use selected educational programms, look for and use information. (CC 2012a: 22-23)

The second educational stage which begins after the third year of learning appears to be ideal time to introduce workshops of building and programming robots. During these classes we are provided with the realization of at least some goals of education and active accomplishment of educational contents such as: science, designing and technology and computer studies (computer science), with the solid training of students' skills and attitudes. On the third educational stage (in lower-secondary school) the offered workshops may become a part of the subject of designing and technology or – while emphasizing programming of ready-made constructions – they seem to be ideal for the realization of algorithmics during computer science classes.

For the subject of designing and technology the core curriculum comprises only the goals of education (basic requirements). It is the teacher who specifies the requirements in detail which result from the selected range and form of classes.

Furthermore, in the supplement to the core curriculum *Recommended conditions and the way of realization*, for the design and technology classes, it is stated that this is the school that draws up and introduces students to the offer of design and technology classes; the sort of classes and the programme which is being carried out should be adapted to the students' interests; the classes might be conducted as regular, weekly meetings or as a project suggested by the teacher or proposed by students, also in the correlation with the project work from other educational classes. (CC 2012b: 326)

Also, the attention was paid to the possibility of combining design and technology classes with the elements of the programme of job pre-orientation for lower-secondary school students.

The regulations which were formulated in this way and which were connected with the organization of design and technology classes allow teachers to draw up their own concepts of conducting design and technology classes on the third educational stage. Design and technology classes enable a relatively full realization of robotic classes, comprising all the stages of work connected with the designing of robots: the specification of conditions, the project, the building and the programming. There are 60 hours of classes in the three years' period of education to the teacher's disposal.

The third educational stage may be considered as a chance or compensation of gaps which came into being on the first and the second educational stage. These gaps may refer to the knowledge, the skills and the attitudes: in the terminology of *European Reference Framework*: the competences.

The suggested classes with robots allow to support the compensation of gaps, particularly in the area of skills and attitudes. Students who are encouraged by their success in designing and building their own robots, may notice the need to complete the gaps or to expand their knowledge. For example it may refer to the mathematics or information technology in the context of the ability of individual programming robotized machines and vehicles which were built by themselves.

In the second chapter the author points out that the core curriculum of general education for the second and the third educational stage allows to introduce the classes of building and programming robots to the educational offer of Polish schools.
# 3. BUILDING AND PROGRAMMING ROBOTS. METHODICAL AND ORGANIZATIONAL TIPS

In the third chapter the author presents the concept of workshops offered by himself. It was raised on the basis of the author's own experiences. He has been conducting classes with children and teenagers with the use of sets for building and programming LEGO MINDSTORMS NXT 2.0 robots for three years.

It is worth noticing that the proposed format of classes does not extort from the teacher using only sets of LEGO company. The methodical concept will also find application in work with other sets which are available on the market.

A solid anchoring of the offered classes in the applied core curriculum of general education might help teachers in overcoming a barrier which perceives education and play as two completely separate worlds of children's activeness.

Bearing that in mind one might negate the sense of using toys (blocks, vehicles) in the teaching process. Among teachers there are attitudes which are characterized by far-reaching scepticism in reference to using LEGO blocks in teaching.

A total opposite of the mentioned attitudes, full of mistrust towards toys and play in education are professor Resnick's views.

Mitchel Resnick (Massauchetts Institute of Technology, USA) orders schools to resemble a kindergarten. To support his thesis he presents several views.

In kindergarten children spend most of their time there creating things: they draw, build and tell stories. Moreover, in kindergarten children cooperate in a group or have a lot of flexibility, can aspire to their interests. Finally, which seems to be the most vital thing, most of our human creative work originates from matters which we really care about. (Mikołuszko 2011)

New technologies in teaching should be used in such a way that could allow to arouse the child's interest in a pupil, a student or an adult, on every stage of education; to encourage or extort active attitudes.

According to Resnick a superior aim of teaching is educating creative thinkers. It is not the point what and how much a man knows but whether he thinks creatively and whether he can find new solutions in new contexts. (Mikołuszko 2011)

The spirit of a kindergarten - which according to Resnick is supposed to be the target form of our education - is reflected (among others) by playing with blocks.

In the classes that the author suggests blocks are not random. LEGO blocks were chosen because they are a brand that is well-known and valued by most parents and their children. LEGO is a brand that is recognized and positively associated all over the world. Therefore, it is worth using this marketing capital in education.

LEGO MINDSTORMS NXT (Figure 2.) is an idea which is expected to 'revive' constructions made of LEGO Technic blocks. The basic assembly element of the robotized set is a central unit NXT (Brick), equipped in 32-bit processor, four input ports for plugging sensors (e.g. touch, colour) and three output ports for plugging



servo motors.

# Figure 2. LEGO MINDSTORMS NXT 2.0: A helicopter built by Mikołaj (10 years old)

#### Source: Author's own resources

A graphical programming environment was prepared for LEGO MINDSTORMS sets (Figure 3.). Programming comes down to building graphic schemes (visual programming). Students may influence their robot's actions by modifying its controlling programme.

A free graphical environment Lego Digital Designer (currently in version 4.3) is intended for designing (3D) in real time LEGO MINDSTORMS NXT.

As a part of the project The Laboratory of Robotics (http://www.roboty.bilesko.pl), which was created and is led by the author of the article, a method of conducting classes with LEGO robots: EduRoboLab was drawn up and tested. This is a modern form of educational classes during which students:

- create objects of their further research such as machines or vehicles,
- carry out research of created models,
- remotely control the work of designed models,
- program autonomous robots,
- work in small teams preferably in pairs,

- use the Net as a source of inspiration a transfer of ideas, not solutions,
- substantiate their projects in a form of multimedia,
- publish descriptions of their research.



Figure 3. A graphical programming environment for LEGO robots: NXT-G Source: Author's own resources

The specification of the method is best described by:

- nouns: workshops, laboratory, research, technology;
- verbs: I try, I search, I create, I experience.

The method is based on the experiences which originate from the work with children and teenagers of Polish primary and lower-secondary schools. It is recommended for primary school students (children from the 4th grade and older) and lower-secondary school students. The best effects are achieved while working in teams of 2-3 students, in groups of 15 students (5 workstations). While working with students at 5 workstations the teacher's-instructor's attention is fully engaged in the classes.

The offered method of conducting classes refers to the thesis of constructivism: knowledge is an individual construction; learning is an active and a constructive process; student is active, teacher supports, offers and advises. (Kapounová 2012: 22)

Obviously, it has its advantages and disadvantages. On one hand – for the student – their own activeness is more accepted by themselves than an abstract lecture, on the other hand – for the teacher – the results of teaching are almost impossible to control. (Kapounová 2012: 22)

Cooperation is highly emphasized by constructivism: both among the teacher and the students, as well as the students themselves; the suggested method of work also fulfills this demand.

A sound support for the suggested method of working with sets for building and programming robots is Seymour Papert's theory of constructionism which originated from the basis of constructivism.

According to this theory the most effective method of creating new skills is including pupils or students in actions during which they can create a specific and an interesting product. It concerns some kind of expanding constructivism which emphasizes solving problems practically, with the use of not only mind but also hands. (Lapeš, Tocháček 2012: 21)

Papert claims that doing is a good way to learn but we learn best of all by the special kind of doing that consists of constructing something outside of ourselves: a child building a tower, writing a story, constructing a working robotic device or making a video game are all examples of constructing and the list goes on indefinitely. (Papert 1999: XIII)

While describing the theory of constructionism, in the paragraph concerning the second great idea of Papert (technology as a material) Andrzej Walat states that having technology at one's disposal we can make much more interesting things and while making them we can learn much more. It is mainly connected with digital technology: all computers, including LEGO controlled by a computer. (Walat 2007)

The next methodological trail: using the Net as a source of inspiration, the necessity to testify the students' work and publish the results. This is a sign of the inspiration of the connectivism, learning by applying social networking sites, learning while we are connected.

Students will not only be receivers of materials available in the Web. They have to create them, share with others, assess their friends' work, search for ideas. To achieve this goal they can use a free social platform NXTLOG 2.0 of LEGO brand (available in English language). They can publish materials on the school's site or on their blogs.

Moreover, in the EduRoboLab method one can notice elements of a strategy of solving problems known as computational thinking. Computational thinking, which is accompanied by the processes of solving problems with use of computers, can be described in the following way:

- a problem is formulated in the way that enables solving it with the help of a computer or other devices,
- a problem is based on a logical organization of data and its analysis,
- the solution of the problem may be received by using algorithmic approach,
- designing, analysis and realization of possible solutions leads to receiving the most effective solution,
- the acquired experience while solving one problem may be used to solve other problems. (Sysło 2012: 3-4)

Workshop classes conducted by the EduRoboLab method (for example with using LEGO MINDSTORMS NXT sets) seem to be a good opportunity for arranging teaching situations in which students learn to think computationally. A different role than usually is anticipated for the teacher here: partly of an instructor, a guide and a coach.

These classes are also a tangible evidence for the use of the acquired knowledge, which has to be applied by the student cooperating in a team: by designing, creating and programming their vehicle or a machine. This may influence the raise of his motivation for learning scientific and technical subjects.

It may be noticed that the form of conducting classes derives from various patterns of teaching and learning, making it possible for the teacher who conducts the classes to decide how much of each element wants to use.

The presented classes provide the development of new interests and are an opportunity to get to know the specification of professions such as a mechatronic or a computer specialist. By participating actively in the workshops students make the first step on the way to the fascination with robots, by the development of their passions till the conscious choice of the field of study and choosing future profession. (Kurytnik 2011)

Workshop classes, in which sets for building and programming robots are used, are an interdisciplinary form of the realization of core curriculum. These classes may be combined with the realization of educational projects (short or long termed) which are recommended in the curriculum as a form of working with students yet on the level of primary school and required on the lower-secondary school level.

## CONCLUSION

Professor Maciej M. Sysło from the University of Wroclaw focuses his attention on difficulties which come out in the development of information education in Poland. One should completely agree with the following statements:

1. The realization of algorithmics as a part of the subject computer science at lower-secondary schools is rare.

- 2. Education with use of computers rarely refers to real applications which students come across everyday.
- 3. The offer of extra classes of the subject computer science in schools as well as the offer of after school classes is rather small. (Sysło 2011: 4)

The classes which were described in this article, the method of conducting them and the tools used for research (robots) seem to be a remedy for problems which are diagnosed in this way because:

- 1. Intuitive graphical programming environment was drawn up for the sets of LEGO MINDSTORMS NXT. Students do not learn the syntax of the exact language of programming but algorithmic way of solving problems. This can encourage teachers and students in an obvious way to programming.
- 2. While designing, building and testing their machines and vehicles students have to face real problems such as: stability and durability of the created construction, the kind of the drive which was used, the need to equip in necessary sensors, the problems of the stage of testing and introducing improvements and many others.

Additionally they have to learn cooperation in small groups and achieving goals in teams.

3. The classes described here are an incredibly interesting form of regular classes, and after school classes. The classes which are conducted in the form workshops guarantee active participation of students while keeping the suggested number of groups and teams.

The proposed classes are ideally connected with the actions which have been recently undertaken in our country and which aim to popularize the technology and scientific classes among the young Polish generation.

#### REFERENCES

- CC, 2012a: *Core curriculum for primary schools*, Annex 2 to the Regulation of the Minister of National Education of 27 August 2012, D.U. 30.08.2012 pos. 977, Warszawa, 2012, pp. 9-67 [In Polish]
- CC, 2012b: *Core curriculum for lower-secondary schools* (...), Annex 4 to the Regulation of the Minister of National Education of 27 August 2012, D.U. 30.08.2012 pos. 977, Warszawa, 2012, pp. 73-326 [In Polish]
- Kapounová, J., 2012: Computer support teaching. The Innovation of the programme of the doctoral studies ICT in teaching, Hradec Králové University, 2012 [Czech]
- KC, 2006: *Key competences for lifelong learning* European reference framework. Annex to the Recommendation of the European Parliament and of the Council

of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006, pp. 10-18

- Kurytnik, I. P., 2011: *The review of the Laboratory of Robotics project*, The Laboratory of Robotics, 2011, available at http://www.roboty.bielsko.pl/home /recenzjaprojektu, (accessed on 29 July 2013) [In Polish]
- Lapeš, J., Tocháček, D., 2012: *Robotized sets*. Training materials for the subject of Automatics and cybernetics and the Input-output communication. Karlova University in Prague, Praha 2012 [Czech]
- Mikołuszko, W., 2011: *Kindergardens instead of schools*, Focus.pl, 2011, available at http://www.focus.pl/cywilizacja/zobacz/publikacje/przedszkola-zamiast-szkol/, (accessed on 24 July 2013) [In Polish]
- Papert, S., 1999: Logo Philosophy and Implementation. Introduction: What is Logo? And Who Needs It? Logo Computer Systems Inc., USA, 1999, available at http://www.microworlds.com/company/philosophy.pdf, (accessed on 28 July 2013), ISBN: 2-89371-494-3
- Sysło, M. M., 2011: Computational thinking. Informatics for all students, 21. Polish Scientific Symposium HUMAN-MEDIA-EDUCATION, Pedagogic University of the Commission of National Education, Kraków 2011, available at http://www.ktime.up.krakow.pl/symp2011/referaty2011/syslo.pdf, (accessed on 28 July 2013) [In Polish]
- Walat, A., 2007: About constructivism and eight principles of effective learning according to Seymour Papert. Meritum. Mazovian Educational Quarterly 4(7)/2007, available at http://meritum.mscdn.pl/meritum/moduly/egzempl /7/7\_8\_abc.pdf, (accessed on 28 July 2013) [In Polish] ISSN: 1896-2521

## EXPERT SYSTEM FOR CATEGORIZATION OF MUSEUM VISITORS

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Abstract: In the past few years, the process of lifelong learning has become more important. A tour of an educational exhibition is an interesting and attractive activity for a person receiving an education. A museum, art gallery, zoological or botanical garden or even a technological park can all be perceived as an educational exhibition. If we want the exhibition tour to provide an educational benefit to the visitor, we need to offer him adequate information about individual exhibits. The exhibition has to be personalized, that is tailored to the various kinds of visitors. This paper deals with the issue of categorizing museum visitors using ICT, specifically an expert system which is a part of a "virtual guide". Based on an initial analysis of a visitor, the virtual guide proposes a tour through the exhibition so that it brings the visitor the maximal educational benefit while at the same time offers information about the displayed exhibits in such a way that is most interesting and comprehensible.

**Keywords:** information and communications technology (ICT), museum, virtual museum (VM), virtual guide, tour route personalization, visitor, categorization

#### **1. INTRODUCTION**

A museum is an institution that conserves a collection of artefacts and other objects of scientific, artistic, cultural, or historical importance and makes them available for public viewing through exhibits that may be permanent or temporary (Alexander, 2008).

ICOM (International Council of Museums, established 1946, resides in Paris, it is an international professional organization with a status of UNESCO consultant) defines a museum as "a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its

environment for the purposes of education, study and enjoyment". The goal of the museum is to present a given topic in an interesting and engaging way. In order to do so, it maximizes the use of its exhibits and available technology. Likewise, it is important for the presented exhibition to have an educational function.

To achieve that function, the exhibition content has to be presented in a way that is interesting and comprehensible for the potential visitor. The range of museum visitors is wide and so it is necessary to customize the tour to some extent. The standard way to do this is a differentiation of informative texts, either as various legends to the exhibits or as printed textual guides. Another step is a personalized tour with a live guide or the introduction of audio guides, used mostly by foreign visitors. With the availability of modern information and communications technologies (ICT) museums enter a new era and the topic of personalization (customization to a particular visitor) is being discussed more often. Among the most common ICT means used in museums in the Czech Republic are information kiosks, topical interactive games, personal guides in communication devices (tablets, smartphones, communicators) or robotic guides.

Virtual museums are a new domain. Thanks to the Internet, a virtual museum allows the visitor to tour the exhibition right from the comfort of his home. From the beginning, there was interest in adapting such a tour to the particular visitor. Thus, the term *virtual guide* came into existence. A virtual guide is software which strives to give the visitor a tour through the virtual exhibition according to his requirements.

Yet another step is the logical interconnection of the real and virtual museum in one unit, the so-called *augmented museum*. In this case it does not matter whether the visitor is physically present in the museum or is there only virtually.

As a part of a project, I wish to create a virtual guide through an exhibition. It should be a software that guides the visitor through the exhibition based on the characteristics given by the user when entering the museum. The virtual guide should present not only suitable exhibits, but also appropriate information related to them. The emphases is placed on the educational benefit of the tour.

It is crucial for the system to "know" the exhibition visitor. This requires an existence of an application which will be able to characterize the visitor and choose an optimal tour route as well as the content of the tour.

#### 2. RESOURCES

In order to create a useful and effective museum exhibition, all its creators, designers and curators have to be well acquainted with the target group. Without understanding the target audience the exhibition cannot succeed because it will not be able to communicate with and foster the interest of visitors. The spectrum of museum visitors is very diverse and there is no general and universal classification. Visitors, however, have some common features upon which we can build our categorization:

- **socio-demographic characteristics**: age, sex, occupation, education, the type of community the resident is from, local or non-local residents;
- **museological characteristics:** motivation for the visit (professional, informational), knowledge of the topic, potential of the tour to engage;
- range characteristics: individual visitor, (various types of) groups of museum visitors, frequency of visits, timescale of museum visit;
- **psychological or physiological characteristics:** reception, intelligential, memory, imaginative, visual, auditive, motoric.

It can be stated that every significant author writing about personalization of museum exhibition created his/her own classification system of visitors.

Eilean Hooper-Greenhill identifies target groups which include (Hooper-Greenhill, 1999):

- families;
- school parties;
- other organized educational groups;
- leisure learners;
- tourists;
- the elderly;
- people with visual, auditory, mobility or learning disabilities.

She then suggests a partition of museum resources, to target, attract and entertain these different groups.

Dean generalizes museum visitors in three broad and much simpler categories (Dean, 1994).

- **Casual visitors**: people who move through a gallery quickly and who do not become heavily involved in what they see.
- **Cursory visitors** show instead a more genuine interest in the museum experience and collections.
- Study visitors: A minority of visitors who thoroughly examine exhibitions with much more detail and attention. They are learners who will spend an abundance of time in galleries, read the text and labels, and closely examine the objects.

Serrell (1996) also divides visitors into three types:

- the transient;
- the sampler;
- the methodological viewers.

She notes that currently museum evaluators are using terms like "streakers, studiers, browsers, grazers and discoverers" to characterize museum visitors' styles of looking and exhibits. But she concludes that this type of categorization is not useful for summative evaluation, suggesting that it is a subjective method of classification, and that it is not fruitful to try and create exhibitions that serve these different styles of visiting. She suggests instead that a more objective means of classification needs to be found, such as the average time spent in the exhibition space.

Based on visitors behavior in physically enclosed space, Veron and Levasseur identified four different visiting styles using metaphors form animal motion behaviors (Veron 1991):

- **The ant visitor,** who spends a long time observing all exhibits and moves close to the walls and the exhibits avoiding empty space.
- **The fish visitor,** who walks mostly through empty space making just a few stops and sees most of the exhibits but for a short time.
- The grasshopper visitor, who sees only exhibits he/she is interested in. He/she walks through empty space and stays for a long time only in front of selected exhibits.
- The butterfly visitor, who frequently changes the direction of the tour route, usually avoiding empty space. He/she sees almost all exhibits, but times vary between exhibits.

Umiker-Sebeok presented four major visitor types with respect to their interpretation of the exhibition space (Umiker-Sebeok 1994):

- **The Pragmatic** is interpreting the exhibition as a classroom or workshop and is interested in "useful" information.
- **The Critical** is interpreting the exhibition as a museum and is interested in the aesthetics of displays, the structure of the collection and the classification of exhibits.
- **The Utopian** is interpreting the exhibition as an encounter session and his/her main goal is the social interaction.
- **The Diversionary** is seeing the exhibition as an amusement park and his/her goal is to have fun during the visit.

McCarthy (McCarthy 2006) determines these categories based on learning styles:

Imaginative – learns by listening and sharing and prefers interpretation that encourages social interaction.

- Analytical prefers interpretation that provides facts and sequential ideas.
- **Common sense** likes to try out theories and discover things for themselves.
- **Experiential** learns by imaginative trial and error.

Also Gardner (Gardner 1996) uses learning styles:

- **linguistic** written material;
- logical-mathematical diagrams, schemes;
- **spatial** maps;
- **musical** audio, music;
- **bodily** manipulation;
- interpersonal social context;
- intrapersonal alone.

These are some examples of classifications that were considered when creating the "virtual guide" system. Of course, there are many different ways of categorization of visitors, but none of them were suitable. By comparing the categories listed above I created my own categories of visitors.

## **3. CATEGORIES OF VISITORS**

For the first phase of this project I decided to divide the museum visitors based on these three criteria: age, social integration and expertise (the extent of knowledge from the field presented in the exhibition).

#### Table 1.

Context	Category				
Social integratio n	Individua 1	Homogeneou s couple	Inhomogeneou s couple	Homogeneou s group	Inhomogeneou s group – family
Age	3–6 years	6–12 years	12-18 years	18-65 years	over 65 years
Expertise	Layman	Expert			

## The original categories of visitors

#### Source: Own elaboration

In theory such division presents 50 variations when creating the algorithm for the guide. To create so many various "paths" seems very complicated, nevertheless not

all combinations are probable or plausible. Furthermore, in the first phase I want to focus on individual visitors only. I presume that each visitor will have his/her own guide, which opens another area for further research. A group of visitors does have a bit dissimilar behavior and exhibition requirements than an individual. Moreover, an exhibition algorithm to suit couples of diverse ages (for example grandfather and grandson, mother and child) should be calculated in the near future.

Beside that, another important variable is the visitor's purpose of the exhibition visit. For that reason, it is necessary to create yet another category The purpose of the visit. This purpose influences the number as well as the type of viewed exhibits, which not only further affect the length of the tour, but also the form and the content of presented exhibits.

Table 2.

The purpose of the visit
Quick overview – inciting the interest, motivation (RP)
Fundamental knowledge (ZP)
In depth research (HS)

The purpose of the visit

Source: Own elaboration

## 4. THE CONCEPT OF THE EXPERT SYSTEM

The planned expert system for categorization of visitors is one of the modules of the virtual guide. The modular structure of the system ensures flexibility and will allow future interconnection to other museum systems, especially to the already existing database of the exhibits. At the beginning of creating the concept of the virtual guide system, I was concerned with its openness. The whole system should be able to function in a virtual as well as in the real environment where the range of museum exhibitions is extensive. (The term museum can be understood as, for example, a zoological or botanical garden, art gallery or even a technological park.) It can even serve as a simulation tool in the design stage of a new exhibition.

The whole system consists of three modules: Besides the Visitor module, there is Exhibit module (It is a database system of exhibits. The exhibit is represented by its form – physical manifestation and content – information about the exhibit.) and Guide module, which chooses the best tour route and level of presented information to the visitor based on the categorization of that visitor and available information about exhibits.



#### Figure 1. The virtual guide system

Source: Own elaboration

#### 4.1 Visitor module

This module is a diagnostic expert system based on test questions which determine the type of visitor. For the needs of the diagnostic expert system, I specified a hierarchic model breakdown of visitors.





Source: Own elaboration

Since the system testing will be performed in an environment of a virtual museum, we can consider individual visitors only. The hierarchic model is pictured in Figure 3.





Source: Own elaboration

Using the Frame script the structure of diagnoses will be as follows:

FRAME individual visitor PART\_OF kategorizace indicators: [age, 3-6, age 6-12, age12-18, age18-65, over65, expert, layman] discriminators: []

FRAME 3-6 years PART\_OF individual visitor indicators: [age3-6] discriminators: []

FRAME 6-12 years PART\_OF individual visitor indicators: [age6-12] discriminators: []

FRAME over 12 years PART\_OF individual visitor indicators: [age12-18, age18-65, over65, expert, layman] discriminators: []

FRAME layman PART\_OF over 12 years indicators: [age12-18, age18-65, over65, layman] dikrominátory: [nesvítí\_světla, nefunguje\_rádio]

FRAME expert PART\_OF over 12 years indicators: [age12-18, age18-65, over65, expert] discriminators: []

FRAME 12-18 years layman PART\_OF layman indicators: [age12-18] discriminators: [layman]

FRAME 18-65 years layman PART\_OF layman indicators: [age18-65] discriminators: [layman]

FRAME over 65 years layman PART\_OF layman indicators: [over65] discriminators: [layman]

FRAME 12-18 years expert PART\_OF expert indicators: [age12-18] discriminators: [expert]

FRAME 18-65 years expert PART\_OF expert indicators: [age18-65] discriminators: [expert] FRAME over 65 years expert PART\_OF expert indicators: [over65] discriminators: [expert]

Each layer is consistent with one question asked by the system. The graph shows that each visitor will be asked only two questions, but because the purpose of the visit plays an important role, there will be one more question. It goes without saying that the expert system will not ask different visitors the same questions. To ask children from the D3 and D6 groups about their level of knowledge or purpose of their visit is irrelevant. It is very important to minimize the number of questions. Too many questions could discourage the visitor from using the virtual guide.

	Quick overview (RP)	Fundamental knowledge (ZP)	In depth research (HS)
3-6 years (D3)	Х	Х	
6-12 years (D6)	Х	Х	
12-18 years layman (L12)	Х	Х	Х
18-65 years layman (L18)	Х	Х	Х
Over 65 years layman (L65)	Х	Х	Х
12-18 years expert (O12)		Х	Х
18-65 years expert (O18)			Х
Over 65 years expert (O65)			Х

Table 3. The anticipated purpose of the visit by categories

Source: Own elaboration

## **5. IMPLEMENTATION**

1. phase – creation and debugging:

- Creation of virtual museum web pages.
- Creation of individual system modules. All modules are placed on the same server as a virtual museum.
- The expert system of Visitor module acquires information through a simple form that the visitor fills out when entering the museum pages. The output of this module will be used in the Guide module.
- Filling the virtual museum database of exhibits Exhibit module. The creation of individual information layers needs to be done with the help of

an educational specialist so that each information layer is appropriate for its audience.

- In the learning phase the neural network (part of Guide module) will use as inputs the classification of visitors and suitable tour routes as outputs. During the tour the visitor can change the proposed tour as well as the level of exhibit information layer. His route will be recorded for possible later editing of the rules of passage.
- In order to obtain relevant data, it is necessary in this phase to have many various visitors take a tour through the virtual museum.
- When leaving the web page of the virtual museum, the visitor can leave feedback in the presented form. This will be added to the data about his tour route and will serve to eventual improvements of the system.



Figure 4. A scheme of the system in the 1. phase of development Source: Own elaboration

- 2. phase testing the educational function
  - Guide module adjustment based on real data gathered from the records of visitors tour routes.
  - Potential modification of virtual guide web design based on the visitors' reactions.
  - Testing of educational functionality of the system on two groups. The first group will be 1st grade students of a primary school, the second group will be students of a secondary school. Part of the students will use the services of the virtual guide, while the others will go through the virtual museum by themselves. After the tour, the degree of knowledge acquired by each group will be compared.



Figure 5. The scheme of the system in the 2. phase of development Source: Own elaboration

- 3. phase implementation in a real exhibition
  - Adjustments for implementation in the real exhibition. Filling the database of exhibits with new records and the creation of new information layers. Also the Guide module has to be modified in order to correspond with new conditions.
  - The whole system will run on the museum's central server. When entering the museum exhibition the visitor will download an application to his smartphone. For those who do not own a smartphone, a lending service will be provided. After running the application, the user will have to answer questions in order to be placed in the right category. His answers will be transferred to the server and the user will receive a map with a plan of the tour route on his smartphone. The application will direct the user through the exhibition to the appropriate exhibit. When at the exhibit, the visitor will place his device on the NFC panel or will download the displayed QR code and the appropriate information layer of the exhibit will be displayed on his device screen. After he is done viewing the information layer, the application will direct him to another exhibit.
  - The visitor will still be able to change the tour route as well as the information layer of the exhibit.

#### 6. CONCLUSION

One of the museum's mission is to educate its visitors. One way to accomplish this mission is to offer an individual approach to the visitor. Different visitors require different information. Modern ICT offers tools that enable the creation of personalized tours. The adaptive guide system is one of those tools. It is vital to choose an appropriate categorization of visitors for such system. However, as there is no universal classification system, it is necessary to develop my own and verify it in practice. The expert system will then take care of the visitor category determination and its output will be used by the Virtual guide as a source for selecting the appropriate tour route. Currently, the expert system is being developed in FEL-EXPERT environment. When the expert system is finished, it will be tested and debugged in the virtual museum. After its educational function is verified, it will be implemented in real museum exhibition, where it will work as an application for a smartphone. In the future I plan to expand the categorization of visitors to groups as well, so that the system is more complex and allows working with various groups of visitors.

#### REFERENCES

Alexander, et, al., 2008: Museums in motion: an introduction to the history and functions of museums. 2nd ed., Rowman AltaMira Press, ISBN: 07-591-0509-X

- Beneš, J., 1981: *Kulturně výchovná činnost muzeí: Část textová, Díl 1*. [Culturaleducative activities of museums] Praha: SPN.
- Dean, D., 1994: *Museum Exhibition: Theory and Practice*. London, Routledge. ISBN: 978-020-3039-366
- Hooper-Greenhill, E., 1999: *The educational role of the museum*. 2nd ed. New York: Routledge ISBN: 04-151-9827-5
- Serrell, B., 1996: The question of visitor styles. In: S. Bitgood (Ed.). Visitor Studies: Theory, Research, and Practice, Vol. 7.1. Jacksonville AL: Visitor Studies Association, pp. 48-53.
- Véron, E., Levasseur, M., 1991: *Etnographie de l'exposition: l'espace, le corps et le sens [Ethnography of the exhibition: space, content and meaning]*. BPI Centre George Pompidou: Paris, ISBN: 978-290-2706-198
- Umiker-Sebeok, J., 1994: Behavior in a Museum: A Semio-Cognitive Approach to Museum Consumption Experiences. Signifying Behavior. Journal of Research in Semiotics, Communication Theory, and Cognitive Science, 1(1):52-100.
- McCarthy, B., McCarthy, D., 2006: Teaching around the 4MAT cycle: designing instruction for diverse learners with diverse learning styles. Thousand Oaks, Calif.: Corwin Press, xiii, 102 p., ISBN: 14-129-2530-4
- Gardner, H., 1999: Frames of mind: The theory of multiple intelligences. Praha, Portal. Print. ISBN: 80-717-8279-3 [In Czech]

# SUCCESSFUL EXAMPLES OF E-LEARNING – ENGLISH FOR ENGINEERING

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**Abstract:** The paper deals with the issues of teaching English for Engineering courses, based on online methodology. The authors describe development, piloting and evaluating four different courses focused on Engineering Technology, Machinery and Equipment, Quality and Control in Mechanical Engineering Production, and Trade and Marketing. Though based on online methodology, the blended method had to be exploited to achieve expected learning outcomes and efficiency of the teaching-learning process. The authors try to underline both positives and negatives both for the teachers and learners.

**Keywords:** E-learning, evaluation, distance learning, foreign language, learning support material lessons, research, survey, teaching

#### INTRODUCTION

The paper deals with the issues of teaching English for Engineering courses, based on online methodology. It is divided into the following parts: the introduction, followed by the definitions of E-learning and methods for supporting communication in E-learning, the introduction of the project and applied methodology and successful examples of E-learning in learning English in the Mechanical Engineering Project, and finally the summary concludes the paper. In the academic circles there is no doubt that E-learning is a significant method of education in the modern world, which backs the modernization and optimization of the educational process in all spheres of modern society. It stands for a potential power all of us both academic workers and professionals from all possible fields need to take into account in the near future.

It seems that E-learning has already become and we believe that it might and definitely will become a more flexible and applied method of how to quickly and flexibly respond to the needs for further training of staff in the employability on the labour market. In the tertiary sector, E-learning has become one of the methods of

university education, which deserves our attention in the following paper supported by the survey.

## **1. THEORETICAL BASE**

Before continuing our reflections on the presented topic in this paper, if we begin by comparing foreign countries along with their the professional literature in this field of education we can agree that it is rather neglected in our country, what can be judged from the number of monographic titles to a formal education. In short, let us mention at least the enumeration of domestic authors dealing with this issue. Here we can come across the following authors: Květoň 2003, Nocar 2004, Barešová 2003, Kopecký 2006, Zlámalová 2009, Vaněk 2008, Zounek 2009, Pejsar 2007 and more.

For our purposes let us mention at this point the following contributions to the studied topic in the field, for instance: The National Conference Proceedings on the 1<sup>st</sup> Distance Education in the Czech Republic (1999), The National Conference Proceedings on the 2<sup>nd</sup> Distance Education in the Czech Republic (2002), The National Conference Proceedings on the 3<sup>rd</sup> Distance Education in the Czech Republic (2004), The National Conference Proceedings on the 3<sup>rd</sup> Distance Education in the Czech Republic (2004), The National Conference Proceedings on the 4<sup>th</sup> Distance Education in the Czech Republic (2006), The (4th) National Conference on Distance Education in the Czech Republic – the Present and the Future, The 5<sup>th</sup> National Conference on Distance Learning in the Czech Republic – the Present and the Future of Alternative Teaching Methods 2009, etc.

Universally and internationally we can come across the following definitions, which clarify the most commonly applied E-learning instruments. According to Mark Nichols in his contribution called A Theory of E-Learning<sup>1</sup> we can find the following definitions of E-Learning. The first one is online learning. It is basically education that occurs only through the Web, that is, it does not consist of any physical learning materials issued to students or actual face to face contact. Purely online learning is essentially the use of eLearning tools in a distance education mode using the Web as the sole medium for all student learning and contact. The second one is mixedmode/blended/resource-based learning. These terms interchangeably describe an approach to education that combines face to face and distance approaches to education in that an instructor or tutor meets with students (either in a face to face mode or through a technological means) and a resource-base of content materials and learning activities is made available to students. In addition, some eLearning approaches might be used. The third one is eLearning. It uses various technological tools that are either Web-based, Web-distributed or Web-capable for the purposes of education. The fourth one is learning object based on a digital file or tool that can be reused in eLearning contexts. The fifth one is Learning Management System (LMS),

<sup>&</sup>lt;sup>1</sup> Nichols, M. (2003). A theory for eLearning. Educational Technology & Society, 6(2), 1-10, (ISSN 1436-4522)

which stands for a collection of eLearning tools available through a shared administrative interface. A learning management system can be thought of as the platform in which online courses or online components of courses are assembled and used from. The sixth one is interactive. There are two types of interactivity, indicative and simulative. Indicative interactivity is typified by the use of button rollovers and site navigation. Clicking a button to start an animation or turn the page is indicative interactivity. Simulative interactivity is interactivity that enables students to learn from their own choices in a way that provides some form of feedback. The ability to select between different Web pages is indicative interactivity; the ability to fly a virtual plane in a realistic virtual environment is simulative interactivity. Finally, the last one is pedagogy, which is traditionally understood to refer to teacher-oriented instruction, however it is now increasingly used to describe the application of sound education practice (which encompasses so-called 'androgogy').

What the following E-learning methods have in common are the following features, which a have a close reference to communication aspects, too. First of all they are more interactive. We can agree that most modern online programs have established unique and innovative teaching techniques for students. It is for some students definitely the opposite of the monotonous structure of lectures and grammar lessons stripped straight from the pages of a boring textbook. Lesson plans are structured to be more interactive, using numerous games, audio files and videos to teach and administer tests and quizzes. Some online programs also contain interactive, speechrecognition software. In some cases, students speak into the microphone installed in most lab tops or desktop computers and the software checks, for instance, pronunciation and accent through different scoring systems, which evaluate the way students have accomplished the desired or trained skill. This is the best solution for those students who are uncomfortable with direct communication or embarrassed to speak in a class setting, what may in some cases lead to greater motivation in the long run. Second, they offer flexible schedule. While most in room-classes require students to have a specific set meeting time. E-learning courses are designed for those who need a more flexible schedule. Some programs also allow students to download lesson plans on their smart devices, which is practical for those who are constantly on the go, as it often the case of distance learning students who go to work on a daily basis at VSP, a.s. As it has been well evidenced by experienced teachers so far, foreign languages do need to be practiced daily in order to properly retain the information, which applies to students doing their foreign language at all levels. Third, students need to be independent. Most distance learning students prefer learning foreign languages online because they can do so in the confinements of their own home or in their offices at workplace. However, if students are generally not individuals who like to work independently then this route might not be ideal for some of them. While most instructors in a traditional classroom setting allow students to work together to complete some assignments and encourage students to hold conversations to improve language skills, online courses do not provide this added social interaction. From the communication perspective, there is no direct exchange of communication. That's not to say that instructors are not available for assistance or students are completely isolated from other students. There are some other solutions to be applied, such as discussion boards, various communication simulative speaking and listening exercises with the necessary feedback in all technical forms and shapes. However, the prerequisite is that students involved in such learning have to be independent and work independently in order to complete assignments. Fourth, one should not neglect the pedagogical support, which is of greatest importance, as it provides for clear guidance and instructions throughout the course. It is also the task of modern university employees to get involved in regular training on E-Learning so that the most professional and latest approaches are applied in the teaching process. Finally, the learning process, which uses E-learning methods should be always supported by common sense, as the latest communication achievements need to respect the basic learning principles based on acquiring different skills in the modern language teaching.

# 2. INTRODUCTION OF THE PROJECT AND APPLIED METHODOLOGY

Developing the study material

The study material for four online modules: Engineering Technology, Machinery and Equipment, Quality and Control in Mechanical Engineering Production, and Trade and Marketing have been developed.<sup>2</sup>

At the very beginning discussion was triggered between companies operating in engineering industries and secondary technical schools located in Opava region. Setting the goals to be reached, while keeping the balance between companies and schools needs had to be clearly defined and outlined. General educational goals had to be modified to current economy needs, while respecting secondary school legislation and reflecting engineering company needs. The issue of IT had to be integrated in a very efficient way.

Mother tongue, foreign languages and computer languages are ways of communicating and their command creates prerequisites for active participation in a human life, while expertise in the field enriched with the active command of these prerequisites is becoming a must in one's professional life nowadays.

In discussion between companies and schools experts from engineering, education, teaching methodology, IT, and even learners were involved so that misunderstandings were eliminated and project objectives achieved. Though based on utilising IT the blended learning method of teaching was agreed on, which allowed the online courses to be supported by classic lessons in a classroom, with the frontal teaching method included.

<sup>&</sup>lt;sup>2</sup> See more at <u>http://www.anglictinaprostrojare.cz/</u>

Four modules: Engineering Technology, Machinery and Equipment, Quality and Control in Mechanical Engineering Production, and Trade and Marketing have been developed, piloted and compared.

Evaluation was performed at regular intervals: before the teaching started, during the teaching, and after the teaching, and followed by final comparison of four modules.

The following objectives, English for specific purposes methodology and contents innovation, cooperation between schools and companies, and support English teachers with placements in companies and involving them into developing study materials were fulfilled.

Structure of study material

When developing study material the aim to learn and practise key words within the context was respected for the whole course, individual modules, and individual units (20 key words per unit).

The teaching material consisted of the online textbook, hardcopy textbook and teacher's handbook. While the online textbook was of a time limited access for the learners, the hardcopy textbook could be kept forever. The hard copy was not the full scope equivalent of the online one due to limited space and appliances not applicable for hard copy versions.

The units of all four modules (10 units per module) followed the same structure, in both online and hard copy versions: Exposition, 3 exercises, Dialogue, 3 exercises, 2 tests, Task, Key words, Vocabulary.

In the Exposition text describing the unit topic ten key words were integrated. Online textbook allowed listening to American English wording. In three exercises key words were practised: in exercise 1 by completing the Czech definitions, in exercise 2 by matching the Czech expressions with the English ones, and in exercise 3 by completing the English definitions.

In the Dialogue expanding the unit topic another set of ten key words was integrated. In three exercises key words were practised: in exercise 4 by completing Czech definitions, in exercise 5 by completing the English definitions. In Exercise 6, video record, listening was practised, with no written text support.

Two tests followed: Test 1 examined spelling; Text 2 examined key words command.

In Vocabulary (and Glossary in on line textbook) learners could check pronunciation while listening both to American and British English.

The final task of each unit was to make a written or oral presentation.

Assessment of learner's performance

All exercises and tests were evaluated immediately and automatically by the system. Final tasks of each unit were evaluated by the teacher. During the course all learners had unlimited access to the online textbook, in exercises they could take unlimited number of tries to succeed in getting one hundred score and be allowed to continue in taking tests and passing to the next unit.

Tests were time limited and learners could take three tries to complete the unit and be allowed to continue in the next unit.

The course duration was the issue being widely and deeply discussed. Learners were expected to study individually, not spending too much time sitting in a classroom. The goal was to strengthen student's skills to organise and monitor their performance, control their studies and take responsibility for the learning results. The opportunity to work at individual pace, and mostly online was considered the greatest benefit, enriched with the opportunity to study also during classic (contact) lessons in a classroom.

## **3. RESULTS 1**

Study materials were developed in cooperation with the engineering companies: MSA, a.s. Dolní Benešov, PRESTAR, s.r.o. Opava, FERRAM STROJÍRNA, s.r.o. Opava, KOMAS, s.r.o. Opava

Four modules, Engineering Technology, Machinery and Equipment, Quality and Control in Mechanical Engineering Production, and Trade and Marketing, all of the same structure and extend, were developed, piloted, and refined.

The target groups of the project, made up of 85 adult learners, mostly technicians, full-time employees, coped well with the blended learning. Technicians appreciated study materials, especially video records filmed in real plants with real workers. Individual techniques, methods descried and filmed triggered a lot of discussion among the learners, especially if from different companies: Střední škola průmyslová a umělecká, Opava, p.o., FERRAM STROJÍRNA, s.r.o, G.M. Project, s.r.o., PRESTAR, s.r.o., KOMAS, s.r.o., TECHNICKÉ LABORATOŘE OPAVA, a.s., OSTROJ, A.s., FEMONT OPAVA, s.r.o., MSA, a.s., BRANO GROUP, a.s..

Since the aim of the course, and individual modules, was to learn and practise key words within the context, the prerequisites were English level B1 at least, and knowledge of engineering.

The course was successfully completed if learners passed all exercises, all tests and all tasks. The course lasted approximately 2 months, usually 2 lessons twice a week, with workload of 20 teaching hours of contact teaching, 10 teaching hours of consultation on the offer, and 20 teaching hours of individual work.

The course duration and balance between the number of contact teaching hours, teaching hours for consultation, and individual work at home was a point of permanent discussion. Students expecting communication missed contact teaching lessons, while those preferring individual work online did not appreciate spending

time in a classroom. The idea was to exploit the online learning as much as possible. Learners were expected to study individually, not spending too much time sitting in a classroom. The goal was to strengthen student's skills to organise and monitor their performance, control their studies and take responsibility for the results. The opportunity to work at individual pace, and mostly online was considered the benefit with the opportunity to study during the contact lessons.

The workload split into three parts: online studies out of a classroom, lessons in a classroom and consultation lessons proved unbalanced. Adult learners mostly did not prefer working individually at home. They preferred working individually, still at own pace, but in a classroom. Introduction into on-line learning/teaching methodology during the first module was really difficult. Both the learners and teachers had to accept the change of the role of a student and a teacher.

The contents of the whole course and its individual modules integrated even the ambition to publish the latest information from the field. Variety of links to resources was provided so that upgrading and updating could be guaranteed. Study material contents were appreciated by adult learners, people already working, while considered rather difficult, by teachers, for secondary school students.

#### Performance assessment

The online study material, its structure and learning instructions for use were user friendly. Learners appreciated immediate and automatic evaluation of their performance, while taking own video records of tasks was considered the most difficult and embarrassing part of the course, both because of technical and personal inconveniences.

The structure of individual exercises and individual units with still slow, but increasing demanding nature formed systematic and logical framework. One hundred score in exercises and tests seemed to be a logical demand but in reality was a little bit demotivating issue. When completing tests with three chances at disposal to pass, learners met a lot of distress and inconveniences. The online structure proved not to be flexible; learners could not skip exercises and tests, which might have caused slowing and hardening learner's performance.

Evaluation of tests had to be modified during the project to motivate participants to continue and speed up. Taking video records of student's task also proved to be rather difficult. The ambition was to motivate learners to deliver a speech and get a feedback from own performance, but due to technical aspects of video recording and personal inconvenience, embarrassment, also evaluation of oral tasks had to be modified. Many learners did not agree with publishing their video records online and experienced distress even in a classroom.

Four different modules were developed with the same aim: to learn and practise key words in the context. Out of these the only one, Trade and Marketing did not fully meet the expectations. Learners missed developing communication skills, which could be not supported by the online study material structure. The target group of module 4 made up of technicians and staff working in sale and marketing departments entered the course with different needs and expectations. The module contents did not match with the online form.

## 4. FEEDBACK RESULTS 2

The questionnaire survey was carried out to gain the feedback both by learners and teachers. The aim was to gather information about learning/teaching process, quality of study materials, and to compare four modules learning/teaching outcomes. Questioning was conducted after completing each module.

Learners

Totally 85 learners took lessons in four modules: Engineering Technology (Module 1), Machinery and Equipment (Module 2), Quality and Control in Mechanical Engineering Production (Module 3), and Trade and Marketing (Module 4).

The questionnaires contained open and close questions. Learners appreciated contents of all four modules, especially from the practical point of view. The aim of the course, and individual modules, to learn and practise key words within the context was successfully completed, Trade and Marketing with being the only exception. The ambition of the module Trade and Marketing was also to develop communication skills, while still based on learning and practising key words within the context. The online textbook did not sufficiently support developing communication skills, so much needed in the field of trade and marketing.

Though user friendly, the online textbook demonstrated a few pitfalls. Technical aspects of video recording were the obstacle, especially for the learners who minded being recorded. The rigid structure of units, the must to follow the preset order of tests, slowed down student's progress. Few comments on the online design appeared.

#### Table 1.

	Module 1	Module 2	Module 3	Module 4
Contents of the module was presented in a clear and concise	1,425	1,24	1,4	1,3
Duration of the module was appropriate, matching the module contents	2,625	1,95	2	1,450
Module was a source of new information	1,525	1,24	1,38	1,54
Knowledge gained from the module is useful for the practical application	1,925	1,62	1,56	1,81

#### Module Comparison by learners

Successful Examples of E-Learning...

Lessons in a classroom were in compliance with the module contents	1,475	1,33	1,14	1,54
Online studies were in compliance with the module contents	1,55	1,38	1,38	1,45
Demanding character of word-stock	1,75	1,53	1,85	2,18
Demanding character of listening	2,475	1,9	2,4	2,27
Demanding character of exercises	1,5	1,48	1,85	2,36
Demanding character of tests	1,775	1,71	2,1	2,27
Demanding character of written task	2,2	2,05	2,28	2,00
Demanding character of oral task	2,875	2,62	3	2,18
Quality of study materials in relation to your job position and working experience	1,875	1,9	1,7	1,8
Organization of the course	1,2	1,05	1,14	1,54
Total rating	1,775	1,67	1,85	1,54

Source: The results of the survey conducted in four modules 2011 - 2013

Rating scale:

- 1 Fully complying
- 2 Rather complying
- 3 Rather unsatisfactory
- 4 Completely unsatisfactory

Conclusion:

Total ratings for individual modules by learners were 1,775; 1, 67; 1, 85 and 1, 54.

#### Table 2.

#### Module Evaluation by learners

Questions	Answers
During the course I appreciated most	Teacher's attitude, word-stock, practical issue
I missed	Due to lack of time I had no chance to work at home, full scope of hard copy textbooks
In the online textbook I appreciated	Unlimited number of trials for exercises, immediate results with underlined wrong

	answers
In the online textbook I missed	Unlimited number of trials for tests, to see test results for unlimited time period
I appreciate most:	Word-stock, training opportunity, practical usage
My recommendations, suggestions:	To eliminate technical problems in exercises based on matching, improve arrangement of exercises, make clearer graphic design of units, provide more lessons in a classroom.

Source: The results of the survey conducted in four modules 2011-2013

#### Module Comparison by teachers

Six teachers delivered lessons in four modules: Engineering Technology (Module 1), Machinery and Equipment (Module 2), Quality and Control in Mechanical Engineering Production (Module 3), and Trade and Marketing (Module 4). All teachers were trained in engineering and teaching methodology and took placements in companies before the lessons started.

Teachers completed teacher's diaries for each module, including suggestions for improvements in contents and methodology, and comments on learning/teaching process.

The data revealed no relevant comments on the contents, structure and complexity of study materials. Teachers brought to the fore the following issues: demanding nature of taking video recording, prerequisites of B1 level at least and knowledge of engineering, pitfalls of the methodology for continuous and final assessment of learning outcomes. Suggestions to modify teaching methodology for module Trade and marketing were made due to different contents nature of the module. Data also revealed that learners did not appraise opportunity to learn on constant and regular basis. Most learners preferred working in a classroom, at own pace.

Teachers were expected to monitor participant's performance and progress on a permanent and regular basis. This way of evaluation, originally meant as a way of motivating proved to be rather a contra productive and de motivating factor. Permanent monitoring was viewed uncomfortable both by teachers and adult learners. Evaluation of learner's performance and progress on a permanent and regular basis seemed to combat the idea of individual pace.

Teachers appreciated evaluation of study materials and learning/teaching process after developing the draft of study material, during delivering the course, and after getting final feedback both by participants and teachers.

Conclusion:

Contents and quality of study materials of four modules complied with current reality in engineering and met the needs of engineering companies. Recommendations to increase the efficiency of learning/teaching process were recorded to upgrade the course.

## CONCLUSION

The objectives, English for specific purposes methodology and contents innovation, cooperation between schools and companies, to provide placements in companies for the English teachers and involve them into developing study materials were fulfilled. The synergic effect was achieved when involving the field expert, experts from pedagogy and andragogy, foreign language teachers into developing and piloting the course. Close cooperation with IT experts cannot be underestimated at any stage, especially when defining specific needs for the study material, online course structure and the target group of learners.

Workshops with experts from companies, schools and municipalities are recommended. Teachers should be properly trained both in the field and blended teaching methodology. Introduction training should be also provided for those not familiar with IT technologies, both learners and teachers.

Among the prerequisites, B1 level, knowledge of engineering, IT skills, the analysis of learner's learning style should be emphasized to achieve efficiency of learning/teaching process.

The balanced ratio between the number of online teaching hours, teaching hours in a classroom, and consultation should be taken into consideration, respecting the target group needs. Though the online study materials underline the benefit of individual pace of learning, learners may insist on prolonging the course duration and/or having more contact teaching hours. Online learning proved to be very efficient for practicing word stock and testing but for learners with communication needs more contact teaching lessons, should be provided. Those preferring individual online learning should be not pushed to spend time in a classroom.

The change of a student's and teacher's roles is necessary. The teacher is becoming an advisor, mentor, encouraging learners, but withdrawing from frontal teaching. Teachers should take much more active role in developing learners speaking skills, while developing reading, writing and listening skills is sufficiently supported by the online study material. Since the goal to strengthen student's skills to organise and monitor their performance, control their studies and take responsibility for learning results was not easily accepted neither by learners or teachers, is should be brought to the fore with more emphasis.

Learning a foreign language is a demanding process of acquiring knowledge and skills. The teacher's role can in no case be neglected. It is the teacher's approach to

learners, which can influence the quality of the educational process, and deal with constrains of online learning/teaching process.

We strongly believe that e-learning courses will be more theory-led than technologyled in the future; as it is supported by Horton's opinion who claims "E-learning does not change anything about how human beings learn"<sup>3</sup>.

#### REFERENCES

- Barešová, A., 2003: *E-learning in adult education*. Prague: VOX, 2003. ISBN: 80-86324-27-3 2
- Islam, K., 2002: Is e-learning floundering? Elearning Magazine, 3(5), pp. 22-26.
- Kopecký, K., 2006: *E-learning (not only) for pedagogues.* 1st edit. Olomouc: Hanex, 2006. pp. 130. ISBN: 80-85783-50-9.
- Květoň, K. *The basics of e-learning 2003*. Ostravská univerzita: Ostrava 2004, 61 p. ISBN: 80-7042-986-0.
- Nichols, M.,: A theory for eLearning. Educational Technology & Society, 6(2), pp. 1-10, ISSN: 1436-4522
- Nocar, D., 2004: *E-learning in distance education*. Olomouc: Univerzita Palackého 2004, pp.77, ISBN: 80-244-0802-3.
- Pejsar, Z., 2007: *Electronic education*. Univerzita J. E. P. v Ústí nad Labem, 2007, ISBN: 978-80-7044-968-4.
- Vaněk, J., 2008: E-learning, one of the ways towards modern forms of education. Karviná: Slezská univerzita v Opavě, 2008. pp. 96. ISBN: 978-80-7248-471-3.
- Zlámalová, H., 2008: Distance learning and e-Learning-teaching text for distance learning Prague: Univerzita Jana Amose Komenského Praha, 2008. pp. 144. ISBN: 978-80-86723-56-3.
- Zounek, J., 2009: *E-learning-one of the forms of learning in modern society*. 1st edit. Brno: Masarykova univerzita, 2009, pp.161, ISBN: 978-80-210-5123-2

<sup>&</sup>lt;sup>3</sup> Islam, K. (2002) Is e-learning floundering? Elearning Magazine, 3(5), 22-26

# METHODS OF TRAINING OF PROGRAMMING FOR FUTURE INFORMATION SCIENCE TEACHERS VIA DISTANCE LEARNING

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**Abstract:** The article describes the main classifications of learning methods from the viewpoint of their application in distance learning of programming. From there, the following classifications are considered: classification by the methods of training material presenting, classification by the main types of didactic problems, and classification by the kinds of cognitive activity of students. Also, the article characterizes the level of skills and ability needed to solve programming training tasks: reproductive, meaningful, probative, and creative programming. The following didactic particularities of approaches to learning of programming are defined: focusing on material covering, algorithms, and on hardware.

Key words: distance learning, programming, learning methods, teaching methods.

#### **INTRODUCTION**

The current state of the national higher education development is characterized by modernization and reforming targeted to joining to Bologna process with purpose of entering to European education and research area.

Bologna declaration (1999) and other Bologna process documents initiated a series of reforms needed for harmonization of the architecture of European higher education system, increase of compatibility, comparability and competitiveness of European higher education, and for increase of its attractiveness for European citizens as well as for other country researchers.

Traditionally, the different types of Ukrainian educational institutions have the following modes of study: full-time education, part-time education, and non-residence education. In recent decades, online study mode (distance learning) has been developing, because of socioeconomic needs and development of new teaching means in the world education system.

Under these conditions, the following trends are spreading: usage of interactive forms and methods of students' work under the guidance of teachers (tutors) and application of individual (self-dependent) work in laboratories, reading rooms, facilities of future professional activity that is especially important for distance learning system.

Internet network is already serves as a model of using technologies to attract students to actively participate in the learning process. Until now, we simultaneously have traditional and distance learning.

Distance learning is the technology which provides for possible usage of the best traditional and innovative means as well as types of learning based on computer and telecommunication technologies (Smyrnova-Trybulska 2007).

Distance learning system of certain higher educational institution includes the following support:

- 1. Methodical ware.
- 2. Software
- 3. Hardware.
- 4. Infoware.
- 5. Orgware.

The key person in the distance learning system is a tutor who is responsible for class hours. Analyzing the foreign universities experience, it is possible to notice that (in most cases) the course developer and tutor is the same person.

## **1. GENERAL CHARACTERIC OF TEACHING METHODS**

A lot of experienced professors prefer (during conducting class hours for students of full-time education) usage of distance learning methods. First of all, it provides for revision, addition and selection of appropriate teaching methods.

Teaching (learning) methods in higher educational institution mean types of interconnection professor-student activity targeted to achieve learning objectives within certain discipline. Learning methods is realized due to the training activity means.

Peculiarities of teaching methods classification is considered in the viewpoint of traditional approaches: by the sources of knowledge acquisition, the nature of cognitive logic, and by the level of individual mental activity.

The most popular and understandable division (classification) of **teaching methods by knowledge sources** is division according to their external form appearance. Based on this, three groups of teaching methods are defined: verbal, visual, and practical (Maksymyuk 2009).
Then we provide description of the **teaching methods by the nature of cognitive logic**. It is obviously to use logic methods (such as analysis, synthesis, induction, deduction, and traduction) in the learning process. These methods also can be effective being in certain interrelation.

Analytical method provides for mental or practical dividing integral (complete) unit into the parts in order to learning of important characteristics.

For understanding integrity of phenomenon, process, concept essence, it is necessary to consider synthesis as the following logic operation. Synthesis is based on mental and practical combining of different elements or characteristics into integral unit. Synthesis is natural continuation of analysis and can be constructed only on its basis.

Logic methods, induction, deduction, and traduction can also be used in the learning process. Inductive method is a way for learning of objects and phenomena (from singular to general). As a result of understanding of characteristics and properties of singular objects and phenomena, we can consider essential, typical conformity or properties of singular (separate) objects and phenomena.

In contrast to the abovementioned, deductive method is based on learning of material from general to separate (singular). Students start to learn general conformity or concept, and then based on this, they characterize other phenomena and objects. Inductive and deductive methods are in dialectical connection.

Traductive method provides for findings from separate to separate, from partial to partial, and from general to general.

Training effectiveness is caused by the methods for organization of thinking. According to the **level of mental activity of students**, **teaching methods** are divided into problem (problem-information), partly search and research instructing.

Problem instructing provides for creation of problem situation (by professor), assistance in defining of problem issue, usage of verbal methods (lectures, explanations) to enhance mental students' activity aimed to satisfy cognitive interest due to getting of new information.

Partly search method attracts students to participate in the search of ways, means for solving cognitive tasks. To ensure the effectiveness of this method, it is necessary to create problem situation and encourage students to understand and "accept" the cognitive task; to control the course of research mental activity of students (using the system of logically motivated questions); to stimulate cognitive activity of students in the task solving process; and to analyze achievements, mistakes, and difficulties.

Research method is targeted to attract students to individual (self-dependent) solving of cognitive tasks with using of necessary equipment. For the method effectiveness, the following requirements should be met: creation of problem situation, students guidance during cognitive task definition; encouraging of students to search of hypothesis (and check of its reliability); assistance in search of effective methods and knowledge reserve needed for solving problems; bring students' focus on research conduction and results systematization; and attracting students to individual (self-dependent) analysis of the course and resalts of the work performed.

### 2. METHODS OF LEARNING PROGRAMMING VIA DISTANCE LEARNING

We consider learning (teaching) methods in the viewpoint of their application during learning of programming via distance learning.

According to the training material delivery, verbal methods (discussion, explanation, narration, and lecture) combined with visual and demonstration methods (illustration. demonstration) can be used for teleconference organization with using proper equipment. Together with the lecture videotranslation, lectures can use additional materials in the form of slides and media files. Concerning visual methods, the main role belongs to demonstration and visualization of data structures (by the professor) and their processing algorithms that allow dynamically show (in the visual form) the course of the program mean performance.

One of academicians (Honcharenko 1997) gives (in "Ukrainian Pedagogical Dictionary") the following definition of a lecture: "A lecture is a systematic and consistent presentation of learning materials, any scientific issues, topics, items, subjects and methods".

Requirements to academic lectures are the following: modern scientific level and deep informativity, persuasive arguments, understandable language, emotionality, clear structure and logic, presence of stunning examples, scientific evidence, justification, and facts.

Practical methods are used for training tasks solving and laboratory (or practical) work performance. Applying these methods, students get knowledge as well as new practical skills.

As a rule, while learning of programming, the practical works content is consistent of different exercises for theoretical material learning. So under the distance learning conditions, check of performing exercises can be realized by review of the performance protocol, or by computer-aided evaluation of test task performance. The laboratory works content consists of tasks, performance of which provides for skills in making algorithms for the computer-aided solving of problems and in the algorithms realization by the use of programming language. In the latter case, before sending (for professors) results of laboratory work performance, students can check correctness of task performance not only by using local computer, but also using server (with the help of the proper resource).

According to the main didactic problems (for solving within class hours), it is possible to define the following methods: knowledge acquisition, methods for skills development, knowledge application methods, methods of creative activity, and competence check methods. Analysis of general didactic learning methods shows that training activity very often is like iterative and incremental process. Considering iteration as step by step going for the certain purpose, it is possible to use iterative approach for training material presenting as well as for process of laboratory works performance. All the more so that specific character of laboratory tasks fully corresponds to iterative and incremental process which is related to construction of models (besides, the each next model is specification or development of the previous one). Laboratory works should consist of the following parts: tasks for individual (self-dependent) work; theoretical material; task solving examples; general learning tasks; and self-control test tasks. Constructing of the final model is like the iterative process; certain additions and specifications appear at each stage of this process. This allows using iterative and incremental approach in the process of learning programming.

Task approach is the most popular at the current stage of learning programming. Modern psychology and didactics consider tasks as the most important factor to stimulate and enhance cognitive and practical human activity. Student thinking development happens due to the problem solving process. The initial stage of this process is a problem situation, because usually people start to think when thinking need occurs.

Programming skills in creating of programming tools (software) are formed directly in the problem (task) solving process on the basis of the theoretical knowledge application.

Task solving method (in programming) is considered as a set of techniques of mental activity or logic actions and operations, which helps to solve lots of problems (tasks); in this case, the method of problem solving is a set of techniques of mental activity or logic actions and operations for solving a separate (special) task. In programming, practically all the tasks have several solving methods (algorithms).

The particular characteristic of solving of programming tasks is the fact that task solution, usually, provides for data structure definition, finding of the necessary processing algorithm, and its realization by means of programming language that needs students' knowledge of proper language instructions as well as skills to work in certain programming environment.

Solving of programming tasks can consist of the following stages: constructing of task information model, searching and constructing algorithms for its solving, and the algorithm realization by means of programming language. The most essential stages of the task approach are the first two. Therefore, it is possible to notice that the programming language is the tool which can be reasonably chosen due to the task character definition.

The experience of learning programming shows that four stages of students' abilities and skills in problem solving can be defined: reproductive, meaningful, probative, and creative programming. Knowledge, received as a result of explanation and illustration method, does not form skills and abilities to use the knowledge. For this purpose, the professor (with the help of task system) organizes student activity basing on repeated reproduction of presented and showed actins methods. Reproduction and repetition of programming problems solving according to the professor's tasks is the main characteristic of the reproductive programming stage.

At the stage of meaningful programming students shall have more knowledge than at the reproductive programming stage; because it is necessary for the students (with no outside help) to determine types of data needed for the task solving, to have skills in the algorithm constructing, to understand constructions of programming language for preparing of the program text, and to test the program. However, at this learning stage of training, students often still see only one algorithm for the problem solving (this algorithm is not always reasonable).

The idea of the probative programming belongs to one of the academics, Yershov (1977). This idea provides for the creation of programs with the proving of their correctness. Constructing and proving the correctness of algorithms and programs faces the following difficulties. For concluding about the algorithm or program mistakes, it is enough to indicate the tests, while performing of which the fail or incorrect result happens. For proving the program correctness, it is necessary to prove that the correct answer is received for the whole of the valid input data. Such assertions can be proved only by an in-depth analysis of results of the program performance in the case of any valid data.

Creative programming is characterized by the novelty of its result for students, the peculiarity of the process of getting the result, and by the essential effect on the mental development. Students, being at the creative programming level, can ensure self-dependent solving of new (unacquainted) problems, deep learning, rapid pace of gaining new knowledge, width of the knowledge transferring to the relatively new conditions, ability to self-dependently form tasks, and use training, scientific or periodic programming literature for new knowledge search. Creative programming shows intellectual abilities of students and their creative potential. Such approach helps to attract students to learning, make them more self-confident, which triggers off their cognitive activity and stimulates the training activity. At the same time, task solving according to the algorithm prepared by the professor does not need individual thinking of the students. Problem solving skills also can be gained only due to the individual work.

In the process of learning programming, it is reasonable to consider the "pair programming" method, when two students simultaneously use one computer for performing tasks. In this case, one of the students does computer work, and, mainly considers coding in detail. Another student considers the task in general and persistently observes the code put by the first student. So, these two students continuously have a dialog concerning the training task and realize interactive learning and control. Change of roles for these students is one of the obligatory conditions of the approach.

In most cases, modern programming is collective, and contribution of each programmer in the general project effects on the team success. It is necessary to understand importance of forming such characters as skills of collective work and cooperation with other teams (e.g., with teachers and resource specialists). The team participants work in order to solve the common (general) task. The participant is individually responsible for the program code, and he/she can assert the best solutions to the problem. Such type of training activity encourages students for individual creative work and deep learning of the programming course.

Considering introductory course of programming, it is possible to define the following learning approaches: approach of maximum material covering, algorithmoriented approach, and hardware-oriented approach.

Approach of maximum material covering provides for consideration of amount of the training material without its deep learning. Application of this approach helps students to entirely understand the course, give them ideas of important themes, instead of focusing on only one problem in detail. So, the students gain a more complex vision of programming that allows them to confidently learn other computer courses. The disadvantage of this approach is the fact that consideration of a wide range of theoretical programming issues (at the early stages of learning) makes difficulties in learning materials by the students of freshman classes.

The Algorithm-oriented approach (while learning of the main concepts) provides for the usage of the pseudocode, instead of the real programming language. Application of this approach minimizes students' efforts for learning specific syntactical construction of specific programming language; but students should prove and explain the created algorithms. This allows students to work with a wide range of data types and basic structures. After learning of the main data types and the processing algorithms, students can start to use one of the programming languages. Due to the exception (from the study program) of the time for learning syntax and details of certain programming environment, it is possible to include additional theoretical material. As a result, students start to learn the theory aspects since the first days of studying.

Hardware-oriented approach provides for learning of computer fundamentals and, in particular, programming fundamentals starting with the hardware-logic level. It is noticed that (in this way) students can learn informatics more deeply and consistently. Transferring to learning of programming of high level is performed only after developing students' understanding of structural peculiarities of hardware, machine logic, and mathematics. From the viewpoint of developers, such approach is more attractive for students who want to understand the process of computer functioning in detail.

#### CONCLUSION

However, hardware-oriented approach is not fully consistent with the modern trends of continuing improvement of virtual machine that disengage the programming process from the hardware environment. This approach can be used for preparing computer engineering specialists, when it is necessary to introduce information on computing hardware.

#### REFERENCES

- Aleksyuk, A.M., 1998: *Pedagogy of Higher Education in Ukraine: Theory*. Lybid, Kyiv, 1998, pp. 314. [In Ukrainian]
- Ershov, A.P., 1977: Introduction to theoretical programming: Conversations about the method. Science, Moscow, 1977, pp. 288. [In Russian]
- Glazyrina, V.M., 2006: *Pedagogy of the modern school. Textbook for students.* Nord-Press, Donetsk, 2006, pp. 220. [In Ukrainian]
- Honcharenko, S.U., 1997: *Ukrainian Pedagogical Dictionary*. Lybid, Kyiv, 1997, pp. 376. [In Ukrainian]
- Maksymyuk, S.P., 2009: *Pedagogy: Manual.* Condor, Kyiv, 2009, pp. 670. [In Ukrainian]
- Moroz, O.H., 2001: *Learning process in Higher Pedagogical School*. National Pedagogical University, Kyiv, 2001, pp. 189. [In Ukrainian]
- Ortynskyi, V.L., 2009: *Pedagogy of High School: teach. Handbook for students*. Center of Training Literature, Kyiv, 2009, pp. 472. [In Ukrainian]
- Smyrnova-Trybulska, E.N., 2007: Basics of Developing the Information Competences of Teachers in the Field of Distance Learning. Monograph. Ailant, Kherson, 2007, 704 p. ISBN 966-630-040-1 [In Russian]
- Zhaldak, M.I., & Ramsky, Y.S., 2012: Formation and development of methodical system for teaching of computer science teaching in schools and universities of Ukraine. Scientific journal of Dragomanov National Pedagogical University. Series 2: Computer-oriented Learning Systems, 13 (20), 2012, pp. 24-41. [In Ukrainian]

#### SCENT - THE FUTURE OF E-LEARNING?

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**Abstract:** The e-learning has successfully developed new applications using scent. Scent communication channels in human-computer interaction can support the learning process and improve the efficiency of learning. Olfactory information can serve to complement or supplement auditory learner, visual or tactile channels. This paper describes how to use scent in new technologies that have the potential to develop computer and Internet methods to support the educational process.

*Keywords:* scent, Shanonn-Weaver fragrance/scent model of communication, fragrance applications, education, human-computer interfaces.

#### **INTRODUCTION**

The use of modern technology and the media in the process of e-learning contributes to the creation of new forms of learning and communication between human and computer. In human - computer interactions there are potential communication channels which use not only the sense of sight or hearing, but also touch and sense of smell. Previous studies indicate that the use of several human senses in multimedia or multimodal interfaces is an effective way of acquiring and storing knowledge, based on the Cognitive Theory of Multimedia Learning, the dual-Coding Theory, and other relevant theories.

Understanding the psychological and physiological mechanisms of the sense of smell led to the use of scent as another medium of communication. Technological developments have contributed to the creation of computer systems using scents that encourage the creation of educational applications. New programs must at the same time meet the basic requirements of usability. According to Nielsen these are:

- efficiency (how users perform tasks at the interface),
- learnability (how users learn to use the computer interface),
- memorability (what users remember about its usage),

- errors (user errors performed at the interface, and how to recover from them)
- satisfaction (the subjective experience of comfort and motivation about using an interface) (Garcia-Ruiz et al., 2008).

Since the 90's there have been more and more applications using Virtual Reality (VR) in the field of learning and education, which extend the traditional 3D graphics world that include stereoscopic, acoustic, haptic and even other feedbacks, like smell and taste to create a sense of immersion. Previous studies have reported that compelling olfactory cues have the potential to enhance the sense of presence, invoke emotion, and provide salient spatial cues. Recent studies indicate that VR using the sense of smell may be used for the support of biology and biochemistry teaching (Garcia-Ruiz et al., 2008; Richard 2006).

Previous studies suggest that odors can play at least four functions in educational applications, provided that they are adequately chosen and adapted to the virtual environment and its context of use. Odors can be used to lower students 'anxiety, to foster students' motivation, to complement or supplement other student's sensory channels, and to enhance educational mental immersion in virtual reality environments. The use of scent in educational technology may increase its degree of usability, increase the effectiveness of learning and teaching as well as positively influence the motivation of users. Aim of this study is to analyze the possibility of combining scents with new technologies that have the potential to be used in e-learning (Garcia-Ruiz et al., 2008).

#### 1. SCENT AND MODEL OF COMMUNICATION

Felt scent is the carrier of information and may be treated as a medium. Fragrances have a special meaning, and can, in a spontaneous and invisible manner, transfer information that cannot be transferred by other media. Youngblut highlights that "odors can be used to manipulate mood, increase vigilance, decrease stress, and improve retention and recall of learned materials". In 2006, Linda Buck and Richard Axel received a Noble Prize for decoding the first olfactory receptors. Their works allowed to explore how the brain discriminates among different odors and to reveal, using a genetic approach, the organization of the olfactory system (Emsenhuber 2011).

In everyday life, scent marketing uses scents to create a friendly atmosphere while shopping and to increase customers commercial activity. In order to improve the mood may special fragrances can be freed during a meeting in the halls and classrooms. Previous studies have shown that in many cases the smell affects the performance of tasks which require alertness and attention, solving mathematical problems. Role of smell in the process of learning and memorizing is increasingly being discussed during various trainings. Both scent marketing and psychological research on the effects of odors may help explain their importance in the process of human-computer interaction. Smell is the carrier of specific information and its perception creates a specific communication channel (Emsenhuber 2011).

#### 1.1 Shanonn-Weaver Communication model

Transmission model of communication developed by Shannon and Weaver, also known as "the mother of all models", is one primary concept of technological communication process. In this model, the beginning is perceived as an information source that produces information. Then, the message gets converted into a signal through a transmitter (encoding) that reaches the channel and gets to the receiver and is sent to the recipient. Disturbance which may appear during the transmission of the message hinders decoding in the receiver (Emsenhuber 2011; Kulczycki 2012) (Figure 1).





In this model, the process of communication is used to transmit, transfer information, knowledge, ideas of feelings using technology - technical tools as a medium. According to Kulczycki, the model can be used to describe the transfer of bits between computers, but also to analyze the processes of teaching. According to McLuhan: "The medium is the message". Therefore, the scent as a medium can also be a message based on the Shannon-Weaver model, which carries additional information and a unique fragrance language (Emsenhuber 2011; Kulczycki 2012) (Figure 2).



**Figure 2. Shannon-Weaver model for olfactory communication** Source: Own elaboration based on (Emsenhuber 2011)

#### 2. ODOR INTERACTION: Human – Computer

The concept of technological communication process based on the scent is used by computer scientists who create and develop human-computer interfaces based on new communication channels using the sense of smell and touch. Human-Computer interactions (HCI) are only possible if there is interface between human and computer, which is accepted by the users. Each interface requires the following functionalities:

- the digitalization of physical information
- the transmission of information
- the reproduction to physical information
- In the case of HCI, three zones can be distinguished:
- The interaction zone
- The notification zone
- The ambient zone

All of them are divided into five different zones resulting from the use of HCI interfaces (Figure 3).



#### Figure 3. Interaction zones in Human-Computer interactions

Source: Own elaboration based on (Emsenhuber 2011)

In zone A and B, the interaction requires physical contact between the system and the user. Therefore the exchange of information is carried out by haptic interfaces. Zone C and D use visual information channel and in zone E only scent - related or

acoustic information is received. Communication takes place in ambient zone of interaction, and each odor emitted creates a scent aura called "Olfactory Interaction Zone." The technological development has enabled the use of interfaces that can produce or detect odors or volatile components. The olfactory displays which evaporate smell and olfactory sensors to detect it can be distinguished. According to the Shannon and Weaver model, this kind of technological systems enables useful communication, also in the description of the learning process (Emsenhuber 2011).

#### **3. SCENT AND TECHNOLOGY**

The first technological systems that use the sense of smell were introduced in the cinema by Hans E. Laube's Smell-o-Vision and Morton L. Heilig's Sensorama, which tried to expand the acoustic and visual experience by adding the scent channel. Further prototypes of new scent systems are created not only for entertainment and advertising, but also as an additional source of information, which also extends perceptions in the personalized human-computer interaction. In 2000, the Aromajet company developed a prototype of odor dispensing device called Pinoke, which can be installed on the user or on the computer (Figure 4).



Figure 4. Pinoke

Source: Own elaboration based on (Emsenhuber 2011)

In 2001 DigiScents company produced iSmell device consisting of pots of oils infused with different scents that could generate new fragrances as a result of mixing primary odors. In 2004, NTT Communication created the first machine called *AromaGeur* that allows to send scented emails and was also used to create ambient smell when listening to the Tokyo FM in Japan. A year later a company named TriSenx produced a device called *ScentDome* which allowed the emission of odors while browsing the web. In 2008, the market witnessed appearance of the device called Osmooze Personal Diffuser, which connected to the USB port of a computer emits a smell when a person opens the email. It is the only such system that has passed the testing phase and became a product that can be bought in the market (Emsenhuber 2011).

Also, the telecommunication industry has used scent channel of communication in the creation of the first scenting mobile phones. The scent has started to play the role of a new sensory modality for interactions between human and mobile devices. In 2008 first "scented" mobile phones appeared on the market. Sony Ericcson SO701 Model has an aroma therapy fragrance to support relaxing during stressful phone calls. The mobile phone also had eight other scents that satisfy different preferences. Other mobile phone models were also introduce by Hyundai, Samsung and Motorola. Currently, various inventors are working on the phone that can send and receive "smell messages" (Emsenhuber 2011).

#### 3.1 The sense of smell in a Human-Computer Interface education – Examples

Currently, some projects are created using the organ of smell in the human-computer interfaces for creating educational applications. An olfactory interface can employ one or more natural or artificially-created odors in a computer interface, with a purpose to its human user. According to Kaye, a computer-generated scent conveys meaningful information to its user(s) if it is semantically and environmentally related to the information to be conveyed (Garcia-Ruiz et al., 2008).

#### 3.1.1 Example 1

Miguel A. Garcia-Ruiz and his colleagues conducted a study with engineering students to see if mint odor assists memorization and recall information during and after reading an educational Web page. Fresh mint leaves were used for this purpose (Mentha Spicata) because prior research suggested that the scent of peppermint (mint odor) helps storing and particularly supports emotional memory. Participants (26 students with an average age of 21) were divided into two groups of 13 people). Each student used a personal computer ( a desktop computer with a standard Web browser and Internet connection) and the students were seated next to each other in rows. First, all participants had to solve a pre-test with the following questions:

- 1. Approximately, how many odors does a normal human nose perceive?
- 2. What are the cilia within the nose?
- 3. Write down the name of the seven types of olfactory cells.
- 4. Write down the names of two diseases of the senses of smell and describe each.
- 5. Explain what olfactory fatigue is.

Next, the participants used the following site: http://es.wikipedia.org/wiki/Olfato, which contained the necessary information on the functioning of the human olfactory system. One group received three mint leaves, which they were suppose to rub and smell while reading, and the other group was just to read the Web page. After the task, each group received a post test with the same questions. In addition, the mint-smelling group received three survey questions with 5-point Likert scales related to the exercise (1 = strongly disagree, 5 = strongly agree) for more feedback on the usability of the mint and the interface:

- 1. The test about the Web page reading and the mint smelling was fun
- 2. I would like to use olfactory interfaces in the future
- 3. I had discomfort when smelling the mint and browsing the Web page

The survey showed that students enjoyed and the test and that they would like to use the sense of smell in further training activities. At the same time, the post test showed that the group of students that use the sense of smell performed the task slightly better (Garcia-Ruiz et al., 2008).

#### 3.1.2 Example 2

Miguel A. Garcia-Ruiz team conducted also a study with the computer science students, to find out if mint odor assists listening comprehension in an English language learning exercise when using a VR environment. The aim of this study was also to broaden the knowledge on how to connect the virtual reality and the smell with the language learning process and to assess the benefits of such solutions. Previous studies by Washburn et al. indicated that the use of the sense of smell combined with virtual reality increases the efficiency in learning and technical trainings without deteriorating the cognitive abilities of the users. The group of students in the study consisted of 12 people. Each student was sitting in front of a laptop with a screen display of 15.4 in computer room with no other students present and use the virtual environment created by a team of researchers, representing a typical Western town, made in DIVE program. Each participant received three mint leaves, which they smelled during the task. Students had to lead their avatar from point A to point B using the arrow keys of the laptop keyboard and according to the following oral instructions in English that included distracters and real-life sounds. Qualitative and quantitative data was collected using direct observations. After the task the usability questionnaires were administered to each participant. Data analysis indicates that the VR has good usability. All students indicated that the smell of peppermint allowed them, to certain extent, to overcome the fear associated with hearing the command in the English language. Moreover, in these studies, the students expressed their desire to continue using the virtual reality and scents in the further process of learning a foreign language (Garcia-Ruiz et al., 2008).

#### 3.1.3 Example 3

Team A. Tijou conducted a research on the effect of olfaction on learning, retention, and recall of complex 3D structures as dry organic molecules using the multi-modal virtual reality applications (Tijou et al., 2006, Richard 2006). The application called "Olfactive Molecules" is intended for undergraduate students in their chemical and biological studies. Students can get familiar with the constitution, 3D chemical structures, and stereochemistry of a few organic molecules using their senses of vision and olfaction. The application uses six exemplary organic compounds that are involved in many biological interactions. (Table 1).

#### Table 1.

### "Olfactive Molecules": common name (a); associated odor (b) (Tijou et al., 2006)

	a	b
1	Cinnamaldehyde	Cinnamon
2	Vanillin	Vanilla
3	Cocaine	Cocaine
4	D-Carvone	Spearmint
5	R-Limonene	Orange
6	S-Limonene	Lemon

Source: Own elaboration based on (Tijou et al., 2006)

The students can experiment with the effect of chirality on the olfactive property of the molecules. Some molecule's names evoke and correspond to a familiar odor such as dry vanillin / vanilla, while others are associated with totally arbitrary scent (cocaine / caramel). The application was developed using C/C ++ program and standard OpenGL graphics library in order to enable easy integration of new interaction techniques and displays. Release and dispersion of scents are provided mechanically by a ventilation system and controlled in real-time by the mouse cursor. Usable scents are available in the market. However, the efficiency of "Olfactives Molecules" application over standard educational tools will be further investigated (Tijou et al., 2006).

#### CONCLUSION

The use of odor in multimodal interfaces can support the e-learning process. Smell as a carrier of information may in the future be used in subsequent new learning applications that require improvements. The smell in the new educational technologies could play an important role in the learning and memorizing process. Scent communication channel in an environment of human-computer interaction reduces stress, increases memorizing skills, enhances memory performance trough a problem-solving, increases work productivity and efficiency, reduces the number of errors and has a positive effect on the motivation of students. The concurrent use of multiple human sensory channels to interact with a computer interface in the classroom and in a computer room, exploiting the learners' human senses to support learning, remains to be one of most important issues in the educational technology.

#### REFERENCES

- Garcia-Ruiz, M.A., El-Seoud, S.A., Edwards A., Al-JA'AM, J.M, Aquino-Santos R., 2008: Integrating the Sense of Smell in an Educational Human-Computer Inerface. In Proceedings of International Interactive Computer Aided Learning International Conference (ICL), Villach, Austria, available at http://www.icl-conference.org/dl/proceedings/2008/finalpaper /Contribution111\_a.pdf (accessed on 1 August 2013)
- Emsenhuber, B., 2011: The Olfactory Medium. Smell in Human-Computer Interaction. Science, Technology and Innovation Studies, 7, No. 1, May 2011, 47-64. ISSN: 1861-3675
- Kulczycki, E., 2012: Sources of transmission-based approach to communication. [Źródła transmisyjnego ujęcia procesu komunikacji.] Humanities AGH, 11/1/2012, pp.21-36, ISSN: 2084-3364 [In Polish]
- Garcia-Ruiz, M.A., Edwards, A., Aquino-Santos, Alvarez-Cardenas, O., Mayoral Baldivia, G.M., 2008: Integrating the Sense of Smell in Virtual Reality for Second Language Learning. In Proceedings of Elearn 2008, Las Vegas, NV. Association for the Advancement of Computing in Education (AACE), available at http://www.editlib.org/p/30042 (accessed on 01.08.2013)
- Tijou, A., Richard, E., Richard, P., 2006: Using Olfactive Virtual Environments for Learning Organic Molecules. Technologies for E-Learning and Digital Entertainment. Lecture Notes in Computer Science, 3942, 2006, 1223-1233, ISSN: 0302-9743
- Richard, E., Tijou, A., Richard, P., 2006: Multi-modal virtual environments for education with hepatic and olfactory feedback. Virtual Reality 10, 2006, 207-225, ISSN: 1434-9957

#### FIELDS FOR/OF CREATIVITY IN DISTANCE LEARNING

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Abstract: Extending applications of computer technologies in distance learning make it similar to all other forms or modes of education. In distance learning, both in its strict sense and broad sense (of education with the computer), there are vast possibilities of applying the assumptions of creative teaching, similarly to other educational forms. These possibilities depend not only on people's (self-)awareness but also (proportionally to it) on the possibilities of more and more advanced computer programmes (software). This positive feedback results in constant increasing of the Turing's test requirements as a specific measure of the technology defining modern times.

**Keywords:** artificial intelligence, cognitive psychology, creativity, creative education, distance learning, Turing's test

#### INSTEAD OF INTRODUCTION – ASSUMPTIONS/RESERVATIONS

The title wording might generate various associations and expectations concerning the directions in which they can develop. All of them cannot be explored in a relatively short text. What will be not presented here either is an (open by nature) list of these associations, although this might be formally desired and heuristically interesting. Thus, some considerations resulting from the applied "path" of reasoning will be provided to the Reader, activated only by some of the associations. Before appropriate analyses are started, some assumptions and reservations will be formulated which will dismiss some of the expectations. The assumptions and reservations will be treated altogether as one category of justifications or rights, doing justice to "ontological accuracy" just by "graphics of the slash". With a lot of simplification, it can be said that the assumptions have positive nature and they indicate the prospects, whereas reservations concern limitations of reasoning.

Such introductory remarks can specify what might be expected in the text and what rather might not.

The assumptions/reservations are as follows.

- The discussion will be conducted from the standpoint of cognitive psychology of creativity and its effects will be formulated exclusively in its language. What arises here is a strong temptation to add that this concerns the so called "pure" psychology - such which does not tend to generate, within its notional apparatus, various kinds of additional meanings (Madsen 1980), especially those of neurophysiological nature. Facing more and more tight and complicated relations which modern psychology (and cognitive psychology in particular) enters within its subdiscipline of cognitive science, it should be doubted whether this is still possible.

- Such traditional (in its best meaning) interdisciplinarity of the approach does not exclude drawing from the output of other subdisciplines of cognitive science the comments on challenges and expectations concerning interdisciplinary approaches can be compared here (Juszczyk 2002, p. 86). However, such threads appear in this study merely as signals. These references seem inevitable and can be confirmed by the so called computer metaphor, which successfully applied in cognitive psychology makes one aware of the dual orientation of cognitive studies. A slightly humorous impression is made currently that it is not known what is modeled by what: computer programme functioning by functioning of human mind or the opposite. Among other things, it is the effectiveness of the computer metaphor which causes that cognitive psychology cannot be defined (a bit intuitively and thus imprecisely) any longer by indicating the field which it explores (broadly or narrowly understood cognition). Nowadays, this is done by indicating the categories used for theory building and for designing empirical studies. Psychology is "cognitive" not because of what it explores but how it deals with its subject matter, which for modern psychology is a much larger area than before. Not only theories of cognition itself are "cognitive" but also theories of what was not earlier considered cognitive or was even opposed to cognition (emotions, motivation, personality). Currently, cognitive attempts at conceptualization of emotions, motivation or personality are regarded as obvious in psychology (which does not exclude "noncognitive" attempts of their conceptualization).

- The issue of the organization of the didactic process is not the appropriate subject matter of the discussion, either. Pedagogical, didactic and methodological threads (if they can be found at all) constitute only its peripheral part.

- The remarks concerning the possibilities of computer programme do not aspire to compose a systematic vision of cognitive character. This concerns general references to broadly understood artificial intelligence, which are inevitable and appear in this study on some occasions. What is left to the Reader's competence is developing them in different directions.

#### 1. (NONSPECIFIC) SPECIFICITY OF DISTANCE LEARNING

Among numerous terms used in expert literature on this relatively young form of education, the term "distance learning" seems the most favourable due to its broadness (more details on the ranges of the applied notions can be found in Juszczyk 2002; Kubiak 2000), as a result of which the following cannot be determined:

- the particular stage of education (elementary school, lower- or upper-secondary school, university or post-graduate studies);
- the number and character of educational areas (general, specialist education);
- the level of institutionalization of education (organized school education, home schooling);
- the proportions of its various forms in the whole educational process (traditional teaching with a teacher, self-education);
- the role of another person in education (independently from this person's status teacher, partner, co-worker, etc.);
- the specificity of the arbiter who evaluates the effects (teacher, team of experts, qualification commission, the learner him/herself, etc.);
- the level of application in education of any technological elements including (and first of all) the computer.

This (certainly incomplete) list suggests and emphasizes various doubts concerning the specificity level of the discussed modern and expanding form of learning – the doubts which might appear already in the very beginning (at the level of defining):

Distance learning is a method of conducting the didactic process when teachers and learners are (sometimes substantially) distant from each other, are not in the same place and they apply for the sake of information flow (apart from traditional ways of communicating) contemporary, very advanced telecommunication technologies by sending: voice, video vision, computer data and printed materials. Modern technologies also enable direct contact in the real time between the teacher and the learner owing to audio- or video-conferences, regardless the **distance** which separates **them** [this and all other highlightings in quotations – JK]. (Kubiak 2000: 12)

Not going into deep and detailed analysis of the doubts or particular ideas comprised in this quotation, it is enough to state, slightly paradoxically, that even such a broadly interpreted category "distance learning" starts to live its own life, not rendering (any more) its full meaning. What tends to be uttered is the changed ending of the last sentence - "... which connects them".

What has been already recorded in expert literature is the consciousness of multiple senses applied to describe this form of science as simply "education with the computer". Such category directly appears in the title of a collective work on this issue (Siemieniecki 1999). This outlines much broader fields for applications of the computing machine in education:

The universality of applying computer tools in social life has its particular consequences in education. Here, the computer is not **another didactic means**, as it may seem, but a powerful **tool for man's intellectual support**. This fact makes the introduction of computers to education result in multiple consequences. (Siemieniecki 1999b: 5-6)

These consequences are catalogued by researchers in the form of numerous lists of specific qualities which such a mode of education presents (Kubiak, 2000; Smyrnowa, Stach, 2012). Some are formed in the language more or less axiologically marked – apart from the terms defining the extent of effectiveness of distance learning, its advantages and disadvantages are discussed (Gałek 2003; Kamińska-Czubała 2003; Próchnicka 2003; Woźniak 2009; Siemieniecki 1999a), as well as its threats (Wieczorkowski 1999; Rutkowska 2002). Without going into details of this motif, the statement only will be pronounced here that these advantages and disadvantages are frequently diagnosed:

- inconsistently – a particular phenomenon is regarded as advantage by some researchers and as drawback by others (Wieczorkowski 1999). What may seem controversial is that Wieczorkowski regards predisposition to self-education as a drawback and limitation. (op. cit., p. 136).

- mutually contradictory – even the same phenomenon can be interpreted as advantage or disadvantage at the same time (Gończ 2002; Wieczorkowska-Wierzbińska 2011). This situation is cognitively interesting as it allows for regarding a particular phenomenon as multidimensional, as a result of which the contradiction might turn out to be apparent. Still, this is also a natural situation as it is related to gradual development of studies into the effects of distance learning. Discovering this multidimensionality can be clearly seen in the history of this research – what should be referred to are the early reports issued several years ago, which were often limited to a laconic and vague statement of the fact on one hand and, on the other, were over-emotional descriptions not confirmed by reliable empirical data and containing elaborated and deepened contemporary analyses.

- both within social or emotional functioning of the learner and within the learner's "purely cognitive" functioning (Wieczorkowska-Wierzbińska 2011). This issue is of due significance for the presented vision of the role of creativity in distance learning.

However, at least two facts deserve elaboration and deeper analysis:

 absence or "trace" manifestation of creativity in expert literature evidently on the side of advantages, not mentioning even the chances and prospects of creativity as an absolutely indispensable quality of contemporary education; - traditional interpretation of creativity as an exclusive and elite activity, scarcely practicable with the help of such a tool as a "ready" programme of the computing machine; such a state may partially result from implementing one of the assumptions of distance learning which allows for (imposes?) leaving a part (usually expressed by percentage) of a particular course for face to face implementation.

What can be allowed here is formulating the hypothesis that this is not the specificity of distance learning. Elements of the so called creative teaching are not present to such an extent and sense which might be expected at any stages (in institutionalized forms) of contemporary education in Poland. It is an "unbearable" paradox that this takes place in the times of general (almost omnipresent) calling for creativity in almost each human activity and in the times of great boom in theoretical concepts and empirical studies on creation. This is a kind of generalization (probably unjust for many creative didactics and methodology practitioners) and the topic itself exceeds the framework of the present discussion.

#### 2. INTELLIGENT TEACHING - CREATIVE TEACHING

Considering fields in education, it is indispensable to refer to the research into artificial education (in all meanings of this term). Its results have found applications in designing distance learning, according to one idea currently regarded as classical:

The variety of computer applications for educational goals is huge and the same number can be worked out for the applications of artificial intelligence (...). All forms of education based on using the computer offer the possibility of automatic data collection and practicing some form of controlled manipulation. However, I would like to focus on a special paradigm of **intelligent teaching**, called model-tracing, which is particularly appropriate for pedagogical aims. (Anderson 2007: 45)

Although creativity is not straight named here ("merely" intelligence is mentioned), this idea seems to herald the direction of further evolution to which computer programming should be subjected. This will help to make the next step – twisting Anderson's phrasing, to be able to talk about "creative teaching". The direction is indicated directly by the highlighted words in the following fragment:

Methodology of model-tracing requires conducting a simulation of how the examined **should** perform tasks and how they do it **in reality**. [bold type – J.K.] (...) Reports of the learner's real responses and their simulations are automatically recorded. (...) at each point, the teacher can make use of the rich interpretation of the learner's probable mental states. The precise way of re-formulating the teacher's cognitive interpretation into teaching methods depends on the theory of learning. On the basis of ACT\* theory, we

elaborated on a set of cognitive principles of teaching which are mostly based on immediate feedback. (op. cit., p. 46)

These principles constitute a harbinger of the next level in increasing the Turing's test (regardless the application of the "weak" or "strong" understanding of the category "artificial intelligence"). A specific key to designing such a "higher crossbar" for a machine is the decision concerning the appreciation of the psychological perspective (Flasiński 2011) in designing the "artificial creator". What is referred here by applying this slightly eccentric term is the idea of Miłkowski, the author of the category "artificial intelligent person" (quoted in: Labenz 2004). It is this perspective which enables applying - in such designing – the analysis of errors made by people in the process of task solving. This is done at least in two ways:

- in order to diagnose the errors and eliminate them from computer programme functioning by improving or perfecting it in an identical task situation as occurs in human functioning;
- in order to make use of the error in designing the functioning of the machine programme to make use in its full sense of "building in" this error as a regular tool and a constructive stage in the process of solving.

It seems obvious that the first possibility, due to its nature, leads to improving the functioning of the machine. Yet, this is the second possibility which enables introducing the elements of creativity into the model of better functioning. This occurs because human creativity appears as a sophisticated, emergent and slightly weird phenomenon. What ranks as most important is that it has less in common with intelligence (familiar to researchers into AI) that it might seem. Not going into details, psychologists generally agree that intelligence and creativity due to their nature are two independent variables. The fact that intelligence can modify (strengthen) functioning of creativity (and it is good when this occurs) does not bear other possibilities of relations between them. Therefore, creative solutions are possible in the case of people of little intelligence, as well as in the case of small children who are still not in the developmental stage of formal operations or the elderly, whose formal operations function worse or are substituted by post-formal operations. Due to this, attempts to stimulate human functioning by the computing machine seem to be very difficult and judged as unfeasible or even nonsensical (Mirski 2000: 112-113). On the other hand - they raise hope for perfecting its functioning, which can occur "from a slightly different side". What is not nonsensical any longer is the permanently current question: how many of routine human activities can be (already) entrusted to the machine? The fact that such attempts are not any longer a common (irritating or even frightening) futuristic fantasy and that the idea of AI itself is not an "illusion or pseudo-problem" (Szumakowicz 2000b: 5) can be confirmed by the organization of the first conference dedicated to "creativity of computers" in 2010 at Coimbra University (Flasiński 2011: 240).

#### 3. FIELDS OF CREATIVITY - HOW TO FIND THEM?

The image of the creative man is shaped by contemporary psychology of creativity (Nęcka, 2001) according to the following assumptions:

- creativity is of more egalitarian than elite character;
- the creative process basically does not require participation of any separate or specific structures and mental processes;
- even though the key element of the structure and course of creative activity consists of cognitive processes and structures, this activity is not limited to them; modern studies on creativity reveal a significant role of motivation and emotions (Tokarz 1991; Kocowski, Tokarz 1991);
- even though the key element among cognitive constituents of creative activity is thinking, other cognitive processes have significant influence on its course; it seems sufficient to mention the research into the role of attention (Kolańczyk 1991), memory or language (Mudyń 1991);
- creative activity presents its dialectical nature;
- creation is subjected to rules of training.

It can be said briefly that creative activity requires specificity in the functioning of:

- perception independent from the field, therefore allowing for collecting information not necessarily needed in a particular situation but situated in appropriate memory stores "at the disposal";
- attention simultaneously intensive and extensive, with a slight advantage of the latter, especially at the green light stage, when access is needed to various data;
- imaginations permeating the stage of generating ideas with them, with appreciation of eidetic imaginations and the ones generated in different sensory codes;
- learning processes a specific and at the same time unspecific transfer, with slight advantage of the latter, responsible for creating foundations for using heuristics;
- memory its each type though with particular appreciation of semantic memory and reminiscence effect, which is sometimes called the memory insight;
- reasoning at the level of rules with definitely more heuristic than algorithmic ones, especially in the green light stage;

- reasoning at the level of operation abstracting on the basis of not necessarily significant (but also "strong") qualities, making remote associations according to the chain model, "over-meticulous" and "overconsistent" deductive reasoning, inductive reasoning based more on carrier than accurate analogy, more carrier than accurate use of metaphors, complicated transforming in various information codes (especially, the so called conceptualization of imaginations and visualization of notions);
- reasoning at the level of formal qualities of its course appreciation of its divergent direction apart from the convergent one (particularly in the green light stage), non-linear structure and possibly numerous cases of insight;
- motivation appreciation of its para-intentional version, sometimes called "motivation without motivation" – motivation of ludic (not task-based), autonomic (not instrumental) and internal character; this is an academic, canonic case of creative motivation; as such, it provides a kind of "mental *perpetuum mobile*" – satisfaction, which activates the next creative process, is drawn from activity itself, not necessarily from information about the result (which might not appear at all); according to researchers, creative activity can be started basically by each kind (even the most instrumental) of motivation;
- emotions among other things, making use of the effect of special balance between requirements and possibilities (flow), the so called paternal effect (related to the feeling of authorship) and various background emotions as creativity stimulants - also in spite of failure or even against it (Czsiksentmihaly 1998);
- personality (a number of variables, not always useful in contrary task situations) - it seems impossible to enumerate these variables without the risk of simplification. The following should be sufficient: lack of excessive sensitivity to public opinion, criticism towards the authorities, and not falling into excessive (self-) criticism. Another group of such qualities comprises tolerance for the lack of information, information incompatibility, notional conflict, as well as readiness for undertaking new and difficult tasks. Some of them are accurately and reliably diagnosed by the Big Five.

The image outlined above indicates directions for the search of creativity fields in contemporary distance learning at the level of:

- 1. types of the presented tasks;
- 2. types of the provided materials;
- 3. types of the expected solutions;
- 4. types of the accepted activities;
- 5. evaluation standards;

- 6. the teacher's role/rank;
- 7. the applied model of distance learning;
- 8. the extent to which the computer is used.
- 1) This regards not only the change of proportion of strictly task situations (in which the solving process may be limited to the application of known and tested algorithms) and problem situations (the solving of which requires the application (or firstly creation) of heuristic rules) in favour of the latter. The change of proportion at the earlier stage is also dealt here the appreciation of independent searching and formulating problems in relation to their "mere" solving. It seems that in this respect, distance learning does not need to be restricted by any conditions.
- 2) As regards the teacher, this consists in providing the most diversified materials and most authorial ones; in the case of the learner – the broadest use of multimedia bases. Such multimedia approach is beneficial for creative translation of information codes. The broadness of information does not need to result in superficiality of education (this is a frequent charge addressed to distance learning - supported by the studies which unmask the myth of multitude of tasks as a positive phenomenon); just contrary – due to extensive attention, it enables creative treatment of information.
- 3) Not each educational task has to be of *par excellence* creative character; on the contrary there are many tasks which should be solved quickly, automatically and with the help of well-tested algorithms; otherwise, the time-consuming creative approach to everything would become a disproportionate educational cost. However, learning simple mathematical formulas or English irregular verbs may involve creative elements, based on highly individualized mnemonic activities involving the semantization of individual experience, verbal games and linguistic jokes (noticing the relation sound/graphical representation meaning) or on noticing formal qualities of patterns (symmetry, repeatability of expressions). Needless to say that the computer which is much faster than the human mind might "suggest" many ideas in this respect. The acceptance of such learning imposes only two conditions the teacher's appreciation of another form of recording knowledge in the learner's memory and a sensible balance of profits and losses of generating and maintaining the developed strategy.
- 4) Solving problems (especially those with substantial shortage of initial information) does not always result in achieving the aim in the assumed extent or may fail to achieve it at all (even after several attempts). Appreciation of the solving process itself is important this is not only the learner's role but also (and first of all) the teacher's. It is sometimes enough not to hasten with the phrase "This is a wrong solution". A deeper analysis of particular phases of the solving process might indicate some valuable

fragments of reasoning. The computer will allow for relatively fast confrontation with alternative solutions (especially in the model involving cooperation and work in creative thinking groups).

- 5) Establishing evaluation standards is one of few autonomic roles of the teacher (not necessarily fulfilled alone). The teacher should see to it that the standards take into account a maximal number of parameters of the obtained solution and that they are not patterns of thought used for many years. In this respect, the teacher turns out to be also a distance learning participant by reaching for other experts' opinions or opinions of computer expert systems.
- 6) The teacher is not any longer the only or even major source of knowledge for the learner. S/he should become rather an animator and guide in the selected individualized educational path. However, in the face of "information flood", it is in this role that the teacher will function the more effectively, the more classical and universal tools for ordering this flood s/he will suggest. They are likely to be found in classical philosophical literature.
- 7) Two basic models of distance learning discussed in expert literature (Potulicka 1988) do not exclude but rather supplement each other. Aiming at broadening the range of both group and cross-group cooperation tasks in solving educational problems does not bear virtues of individuality and autonomy (or even the niche character) of a particular learner's knowledge. The model is creative by nature and its implementation "from the distance" allows for emphasizing the merits of the work performed by the collective creative mind (time saving, synergy) with simultaneous weakening or eliminating its drawbacks (abandoning or alleviating the fear of appearing ridiculous due to "covering" with a computer).
- 8) Multifunctionality of the high generation computer is the foundation of the search for creativity fields. This consists in a specific courage to treat it as an "extraordinary" tool not only as a data provider but also as a kind of the "alter ego" of the creative mind.

#### INSTEAD OF ENDING - WILL THIS BE CONTINUED?

Creativity itself and creativity in education in particular is an expensive (also timeconsuming) activity. Therefore, what has become a necessity is including the computer (programme) into education in the distinguished fields. This does not regard the fact but the extent. The prospects substantially depend on the sensible alternative to commutative approaches in programming the functioning of the machine:

Maybe when calculations become sufficiently complicated, they acquire the qualities of subjectivity and creativity, which are associated with the notion of

"mind". Yet, it is hard to get rid of suspicions that in such an image of reality something is missing. (Penrose: 489)

Moreover, the prospects depend on noticing the right relation between AI and AC. The contemporary psychological approach to creativity suggests directions of the search for it. For the time being, it can be said that what currently lasts is the "calm and heuristically polite" simulation phase, which results in "mere" supporting human creation by the machine. However, the aggregation phase will take place soon, in which the programme of "creative computer", designed with "cognitive spirit and swing", will increase the TT crossbar for the creative man. In this sense, the "futuristic cranking" of the next phase can be accepted because at this stage (limited?) substitution will be already possible. This is an echo of Bolter's idea: the Turing machine gave birth to Turing's man and this man to another machine – and so on in a circle in accordance with positive feedback.

#### REFERENCES

- Anderson, J., R., 2007: Methodologies of human knowledge research. n: Chlewiński Z. (ed. ), 2007: Cognitive psychology of last three decades of 20-th century, first edition, GWP, Gdańsk, pp. 27-52, ISBN: 83-60083-16-9 [In Polish]
- Bolter, J., D., 1990: *Turing's Man: Western Culture in the Computer Age*, translated by Goban-Klas T. PIW, Warszawa, 83-06-01940-7 [In Polish]
- Czsiksentmihalyi, M., 1998: Every day's charm. Psychology of emotional flow. Wydawnictwo W.A.B., Warszawa, ISBN: 83-87021-47-4 [In Polish]
- Flasiński, M., 2011: Introduction to artificial intelligence. Wydawnictwo Naukowe PWN, Warszawa, 978-83-01-16663-2 [In Polish]
- Gałek, H., 2003: Distance learning course making, In: Kocójowa M. (ed.), 2003: Distance learning. New information and library technologies. First edition, Wydawnictwo UJ, Kraków, pp. 55-59, ISBN: 83-233-1750-X [In Polish]
- Gończ, E., 2000: Distance learning trend or chance?, In: Wrycza S., Wojtkowiak J (eds), 2000: Distance learning. Challenges - trends – applications. Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, pp. 36-58, ISBN: 83-7326-064-1 [In Polish]
- Hetmański, M., 2000: *Mind and machines*. A critics of computational theory of mind Wydawnictwo UMCS, Lublin, 83-227-1602-8 [In Polish]
- Juszczyk, S., 2002: Distance learning. Concepts, rules and processes codification. Wydawnictwo Adam Marszałek, Toruń, ISBN: 83-7322-291-X [In Polish]

- Juszczyk, S., (ed.), 2000: Interactive communication between man and computer. Oficyna Wydawnicza "Impuls", Kraków, ISBN: 83-88030-48-5 [In Polish]
- Kamińska-Czubała, B., 2003: Educational web platforms in: Kocójowa M. (ed.), 2003: Distance learning. New information and library technologies. first edition, Wydawnictwo UJ, Kraków, pp. 70-78, ISBN: 83-233-1750 X [In Polish]
- Kocowski, T., Tokarz, A., 1991: Procreative and anticreative mechanisms of creative activity. In: Tokarz A., (ed.), 1991: Stimulators and inhibitors of creative activity. SAWW, pp.79-95 [In Polish]
- Kolańczyk, A., 1991: Function of attention in process of creative intuition. In: Tokarz A., (ed.), 1991: Stimulators and inhibitors of creative activity. SAWW, pp. 33-48 [In Polish]
- Kubiak, M., J., 2000: Virtual education. School, Internet, Intranet. Wydawnictwo "MIKOM", Warszawa, ISBN: 83-7279-032-9 [In Polish]
- Labenz, P., 2004: Conversational artificial intelligence; from Turing to Potiomkin. In: Szymanik J., Zajenkowski M. (eds), 2004: Cognitive science. Thinking about the mind – deliberative and undeliberative. Koło Filozoficzne przy MISH UW, Warszawa, pp. 95-112, ISBN: 83-915323-2-1 [In Polish]
- Madsen, K., B., 1980: *Modern theories of motivation*. translated by Jakubczyk A., Łapiński M., Szustrowa T., PWN, Warszawa, ISBN: 83-01-00402-9 [In Polish]
- Mirski, A., 2000: Natural and artificial intelligence or agent and object intelligence. in: Szumakowicz E., (ed.), 2000: Limits of artificial intelligence. Essays and studies. Wydawnictwo Naukowe DWN, Kraków, pp. 83-114, ISBN: 83-7242-119-6 [In Polish]
- Mudyń, K., 1991: Language inspired social limitations of cognition their overcoming by language operations. in: Tokarz, A., (ed.), 1991: Stimulators and inhibitors of creative activity, SAWW, pp. 20-32 [In Polish]
- Nęcka, E., 2001: *Psychology of creativity*. GWP, Gdańsk, 83-87957-50-X [In Polish]
- Penrose, R., 1995: The Emperor's New Mind: Concerning Computers, Minds and the Laws of Physics. transl. by Amsterdamski P., PWN, Warszawa, ISBN: 83-01-11819-9 [In Polish]
- Potulicka, E., 1988: University distance learning in west Europe and America. Institutions, theories, goals of programs and methods projects – developmental trends and typology. Wydawnictwo UAM, Poznań, ISBN: 83-232-0089-0 [In Polish]
- Próchnicka, M., 2003: Information behaviour of participants in distance learning, In: Kocójowa M. (ed.), 2003: Distance learning. New information and

*library technologies.* first edition, Wydawnictwo UJ, Kraków, pp. 126-132, 70-78, ISBN: 83-233-1750-X [In Polish]

- Rutkowska, L., 2002: Distance learning methods and software. In: Wrycza S., Wojtkowiak J. (eds), 2002: Distance learning. Challenges - trends – applications. Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, pp. 59-82, ISBN: 83-7326-064-1 [In Polish]
- Siemieniecki, B., 1999a: Common applications of IT their effects. In: Siemieniecki B. (ed.), 1999: Education with computer – future perspectives. Adam Marszałek, Toruń, pp. 39-50, ISBN: 83-7174-212-6, ISBN: 83-7174-481-1
- Siemieniecki, B., 1999b: Introduction, In: Siemieniecki B. (ed.), 1999: Education with computer – future perspectives. Adam Marszałek, Toruń, pp. 5-7, ISBN: 83-7174-212-6, 83-7174-481-1 [In Polish]
- Szumakowicz, E., 2000a: Artificial intelligence problem or pseudoproblem? In: Szumakowicz E. (ed.), 2000: Limits of artificial intelligence. Essays and studies. Wydawnictwo Naukowe DWN, Kraków, pp. 11-42, ISBN: 83-7242-119-6 [In Polish]
- Szumakowicz, E., 2000b: Introduction. In: Szumakowicz E. (ed.), 2000: Limits of artificial intelligence. Essays and studies. Wydawnictwo Naukowe DWN, Kraków, pp. 5-7, ISBN: 83-7242-119-6 [In Polish]
- Smyrnova-Trybulska, E., Stach, S., (eds), 2012: Using LCMS Moodle as a system for distance learning support. Studio Noa, University of Silesia, Katowice. ISBN: 978-83-60071-56-4
- Tokarz, A., 1991: *Emotions and its stimulators in creative process*. In: Tokarz A., (ed.), 1991: *Stimulators and inhibitors of creative activity*, SAWW, pp. 96-110 [In Polish]
- Wieczorkowska-Wierzbińska, G., 2011: Psychological limitations. Wydawnictwo Naukowe Wydziału Zarządzania UW, Warszawa, ISBN: 978-83-61276-64-7 [In Polish]
- Wieczorkowski, K., 1999: Distance learning its present and future. In: Siemieniecki B. (ed.), 1999: Education with computer – future perspectives, Adam Marszałek, Toruń, pp. 107-42, ISBN: 83-7174-212-6, ISBN: 83-7174-481-1 [In Polish]
- Woźniak, J., 2009: *E-learning in business and education*. Wydawnictwa Akademickie i Profesjonalne, Warszawa, ISBN: 978-83-7644-031-6 [In Polish]

#### INTERACTIVE ENVIRONMENTS AND EMERGING TECHNOLOGIES FOR E-LEARNING ACCORDING TO INTERNATIONAL STANDARDS

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**Abstract:** The aim of this paper is to analyze the international standards on the use of interactive environments and emerging technologies for e-learning. The article presents the most important international standardization organizations. The selected documents and the data models for e-learning environments are presented. The information model, which should be used in interactive environments and emerging technologies for e-learning, was specified.

**Keywords:** e-learning, interactive environments, emerging technologies, international standards, data models.

#### **INTRODUCTION**

Access to automated tools and teaching materials enables a typical e-learning environment - Virtual Learning Environment (VLE) in the navigation menu and icons. However, there are new interactive environments and new technologies for elearning. A new kind of student requires an appropriate environment that is individual and provides flexible access to learning. Particularly important are terms such as interactivity (*feedback between student and teaching material*, *forcing the students to take some action*) (Przybyła, Ratalewska 2012) and interoperability (*the ability of computers to communicate with one another using a common set of protocols*) (Mortimer 2001). The dynamic, interactive and social aspects of Web 2.0 have great potential to promote innovative teaching. Semantic Web enables computers and people to work, 3D virtual worlds expand reality and help to deepen their understanding of the subject, and mobile technologies to increase opportunities for personal development. The application of these technologies in e-learning requires continuous research and determining appropriate standards. These standards are developed by the relevant groups and institutions. Selected international standardization and the international standards organizations are presented below.

#### 1. INTERNATIONAL STANDARDIZATION ORGANIZATIONS AND INTERNATIONAL STANDARDS

The standardization of e-learning is essential for the development of exchange of courses between institutions and quality control. ISO (International Standards Organization), CEN (European Committee for Standardization) and IEEE LTSC LOM (The Institute for Electrical and Electronics Engineers Learning Technologies Standards Committee are among the main organizations involved in standardization. List of documents published by the various committees and working groups are presented in the Annex to the article.

#### 1.1 ISO/IEC

International Organization for Standardization (ISO) is a non-governmental organization, which brings together the national standards organizations. It cooperates with the International Electrotechnical Commission (IEC). International standards and guides for conformity assessment, developed jointly by ISO and IEC, to encourage best practices, analyzing the products, services, systems, processes and materials for the rules, regulations or other specifications (ISO/IEC Information Center 2013). These organizations have published many documents for learning and e-learning (a list of these documents is presented in the Annex to the article). Work on the preparation and publication of new documents are also conducted (see Annex to this article).

#### 1.2 ISO/TC 232 Learning services outside formal education

Technical Committee ISO/TC 232 *Learning services outside formal education* deals with standardization requirements for learning services outside formal education including vocational and professional education and training. Term, and what qualifies as a *formal education* varies depending on the standard user's jurisdictional domain.

Standards developed by ISO/TC 232 are designed primarily for learning services outside of formal education. However, they may be deemed useful by the suppliers of all kinds of educational services. The exceptions are the standards in the field of information technology for learning, education and training. ISO/TC 232 considers the needs of people with visual and/or special needs. It also includes a global policy in regard to the ISO part of the world that are not directly represented in the proceedings (ISO/TC 232, 2013). ISO/TC 232 has published a document ISO 29990:2010 (see Annex to this article).

### **1.3 ISO/IEC JTC 1/SC 36** Information technology for learning, education and training

ISO/IEC JTC 1/SC 36 ITLET is a subcommittee of the Technical Committee JTC1, acting within the framework of ISO/IEC, which brings together representatives of the International Organization for Standardization and the International Electrotechnical Commission. The objective of the ISO/IEC JTC 1/SC 36 ITLET is standardization of information technology in learning, education and training to support individuals, groups or organizations, and to enable interoperability and reuse of resources and tools, with the exception of standards and technical reports that define educational standards, cultural conventions, learning objectives, or specific learning content (ISO/IEC JTC 1/SC 36, 2013).

Committee ISO / IEC JTC 1/SC 36 ITLET consists of the following working groups:

ISO/IEC JTC 1/SC 36/WG 1	Vocabulary
ISO/IEC JTC 1/SC 36/AG 1	Business planning and communications
ISO/IEC JTC 1/SC 36/WG 2	Collaborative technology
ISO/IEC JTC 1/SC 36/WG 3	Learner information
ISO/IEC JTC 1/SC 36/WG 4 and training	Management and delivery of learning, education
ISO/IEC JTC 1/SC 36/WG 5	Quality assurance and descriptive frameworks
ISO/IEC JTC 1/SC 36/WG 6	Platform, Services, and Specification Integration
ISO/IEC JTC 1/SC 36/WG 7	ITLET - Culture, language and individual needs

Some standards developed by ISO/IEC JTC 1/SC 36 ITLET, was published. Other standards are being developed. The list of published standards are presented in the Annex to the article.

### **1.4 CEN/TC 353** Information and Communication Technologies for learning education and training

CEN Technical Board created in 2007 a new Technical Committee CEN/TC 353 to work on the standards in the field of information and communication technologies for learning, education and training. Learning, education and training in Europe are increasingly making use of information technologies and communication. It is expected that the benefits from the use of European standards will include: increasing the quality of European e-learning products, services and processes, enhance interoperability and reduce development costs of e-learning (CEN/TC 353, 2013).

The responsibilities of the Technical Committee CEN/TC 353 also includes: the development of standards for vocabulary, structure, quality and competence, and

collaboration and cooperation with the CEN Workshop on Learning Technologies (CEN Workshop 2013).

As part of this cooperation following documents are prepared: CWA 16655-1:2013 (Part 1-3) (see Annex to this article).

#### 1.5 CEN Workshop

Traditional CEN standardization of work opportunities has been extended to the CEN Workshop. Workshops were created for the needs of the market, creating a bridge between consortia documents and European standards. The CEN Workshop Agreement published CEN Workshop Agreement (CWA), which are less formal documents than the traditional European Standard (EN). CWA meets the market demand for alternative, more flexible and faster solution. Participation in the workshop is therefore open to everyone, even for non-Europeans, and the opportunity to participate is previously announced by the organizers of the Workshop, CEN and its member organizations. CEN/WS LTS - *Learning Technologies operates within this group* (CEN Technical Committees 2013).

Publications CEN Workshop Agreement are owned by CEN. CEN members agreed that some publications CWA may be available on the Committee's website for the electronic download for free. Note, however, that they cannot be modified, redistributed, sold or repackaged in any form without the prior consent of CEN, and are intended only for the person who gets it (CEN Learning Technologies 2013). The list of papers are presented in the Annex to this article.

#### 2. ANALYSIS OF SOME INTERNATIONAL STANDARDS

The analysis of the selected international standardization Organizations helped to choose publications especially important for interactive environments and emerging technologies for e-learning. ISO/IEC 24751 and ISO/IEC 19778 are characterized below.

#### 2.1 Standards ISO/IEC 24751

ISO/IEC 24751:2008 Information technology – Individualized adaptability and accessibility in e-learning, education and training offers a framework and reference model access for all criteria for their personal needs and preferences and discusses digital resource description. It is published in three parts (ISO/IEC 24751:2008, 2013).

## 2.1.1 ISO/IEC 24751-1:2008 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Part 1: Framework and reference model

Part 1 provides a common framework for describing the needs and preferences of the learner and the description of digital learning resources, so that individual preferences and needs of the student can be matched to the appropriate user interface tools and digital learning resources.

# 2.1.2 ISO/IEC 24751-2:2008 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Part 2: "Access for all" personal needs and preferences for digital delivery

Part 2 defines information model describing the student (learner) or the needs and preferences of the user when accessing digitally delivered resources or services. This description is consistent with the description of the needs and preferences of the users in accordance with education delivery. This section discusses the basic principles of the standards adhered to in the development of this model to describe the needs and preferences of people. It provides a justification for the use of a functional approach to description of the needs, possible ways to create your own needs and policy preferences, the main group needs and preferences in different combinations of needs and preferences in terms of priorities and principles of the use of generic and application-specific needs and preferences.

# 2.1.3 ISO/IEC 24751-3:2008 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Part 3: "Access for all" digital resource description

Part 3 discusses a common language for describing digital educational resources in order to facilitate matching of those resources to meet the needs and preferences of learners (as described in ISO/IEC 24751-2). This description is consistent with the description of user needs and preferences in accordance with education delivery (as described in ISO/IEC 24751-1). The standard covers the basic rules to be observed in the development of this model to describe digital learning resources. It explains the assumptions, the concept of the notion of an original and adapted resource, the major categories of metadata for original and adapted resources, the concept of mode of access to the resource and adaptability and interoperability. It also describes how these terms should be used in the model information and how ISO/IEC 24751-3:2008 can be extended.

#### 2.1 Standards ISO/IEC 19778

ISO/IEC 19778:2008 Information technology -- Learning, education and training --Collaborative technology -- Collaborative workplace – applicable to common technology used to support communication between students, instructors and other participants. The deployment and use of these technologies creates communication of information relating to groups of participants, as well as collaborative environments, features and tools that are used by these groups (ISO/IEC 19778:2008, 2013)

## 2.2.1 ISO/IEC 19778-1:2008 Information technology -- Learning, education and training -- Collaborative technology -- Collaborative workplace -- Part 1: Collaborative workplace data model

Part 1 defines the data model that lets you transfer and reuse such data in an integrated form and allows to change them, store, retrieve or being analyzed by different systems. It specifies a table-based approach for defining Data Models. The model specification data is used to determine the data model of cooperation in the workplace.

#### 2.2.2 ISO/IEC 19778-2:2008 Information technology -- Learning, education and training -- Collaborative technology -- Collaborative workplace -- Part 2: Collaborative environment data model

Part 2 defines the data model for a collaborative environment. The collaborative environment Data Model composes collaboration tools, determines their common features and names. These names can be used as a reference for common tools and common function set out in detail in the following specifications or standards. If the specifications are not available or identified, presented interpretations can support the harmonized use of these names.

## 2.2.3 ISO/IEC 19778-3:2008 Information technology -- Learning, education and training -- Collaborative technology -- Collaborative workplace -- Part 3: Collaborative group data model

Part 3 defines the data model for a collaborative group. The Collaborative group data model is composed of roles that can be played by the participants in the collaboration, declares the intended role holders and assigns participants to owners of these roles. Role names can be used as a reference to the roles defined in the following specifications or standards. If the specifications are not available or identified, presented interpretations can support the harmonized use of these names. Participant identifiers can be used as a reference to the detailed information on the participant and used in the user management.

### 3. RESULTS OF THE ANALYSIS OF SOME INTERNATIONAL STANDARDS

Issues such as the user interface tools and description of the digital learning resources as a result of this analysis was noted. Works on standards on the framework and reference model for semantic interoperability have been initiated. The notion of an original and adapted resource, the major categories of metadata, the notion of an access mode for a resource, the importance of interoperability was included in the description of the digital learning resources. Types of information that should be used in interactive environments and new technologies in the field of e-learning are discussed below.
## 3.1 Model of the digital resources

Information technology issues were discussed in the context of the individual learner preferences and adaptation of the appropriate user interface tools and digital learning resources. Information technology (IT System) – is defined as *set of one or more computers, associated software, peripherals, terminals, human operations, physical processes, information transfer means, that form an autonomous whole, capable of performing information processing and/or information transfer (ISO/IEC 24751-1:2008, p. 7). Digital resource (DR) – this is any type of resource that can be transmitted over and/or accessed via an information technology system (ISO/IEC 24751-1:2008, p. 5). The abstract model of the digital resources is specified in ISO/IEC 24751-1. This model consists of the following elements: description, digital resources, needs and preferences, and AfA (access for all: AfA content preferences, AfA display preferences, individual or AfA agent) (ISO/IEC 24751-1:2008, p. 15).* 

### 3.2 Data model

The Data Model for a collaborative environment is specified in the ISO/IEC 19778-2:2008. This model composes collaborative tools and declares their collaborative functions by specifying their names. The elements of the model are as follows: assigning a composition of collaborative tools and declaring collaborative functions to a collaborative workplace, referencing a specification of collaborative tools, adopting names of specified collaborative tools, specification or standard for collaborative tools, specification or standard for functions, adopting names of specified collaborative functions, referencing a specification of collaborative functions (ISO/IEC 19778-2:2008, p. VI). If there is a need for greater co-operation, external standards and specifications are required. To define a set of tools for cooperation and collaboration features you have to be able to define their names and describe their characteristics.

## 3.3 Information models

The Information Model specifies in the ISO/IEC 12785-1:2009. This model defines the data structure that can be used to exchange content of language, education and training (LET) between systems that wish to import, export, aggregate and disaggregate of packages of LET content. For those tasks, you need a conceptual model. The Content Packaging Information Model illustrates the conceptual model and defines the following elements: the structural relationships, data-type, value-space, number of occurrences permitted for each kind of information object (ISO/IEC 12785-1:2009, p. 1).

The Information Model for InLoC (Integrating Learning Outcomes and Competences) is defined in CWA 16655:2013. InLoC contains information models that allow you to define both the intended learning outcomes and competences (LOCs). InLoC helps manage and exchange learning outcomes and competences, by

identifying common characteristics of learning outcomes and competences, and molding them into formats that can be shared. There are two main things that are modeled: a learning outcome or competence (LOC) and the structure that contains several LOCs (learning outcomes and/or competencies). Each LOC has a globally unique identifier. The information that is useful to determine the performance or ability to learn includes: name and a description, levels and credit, topic (CWA 16655:2013, p. 4).

### CONCLUSION

The interactive environments and emerging technologies for e-learning are the subject of several standards. On the one hand, we draw attention to user's needs and individual preferences, providing a justification for the use of a functional approach to description of the needs, possible ways to create your own needs and policy preferences.



Figure 1. Elements of the Information model for e-learning environments

Source: Own study

On the other hand, a description of digital resources, the major categories of metadata for original and adapted resources, the concept of mode of access to the resource and adaptability and interoperability are analyzed. These two approaches offer a common model that can be described as a model of information. Various models of information that should be used in interactive environments and new technologies for e-learning have been defined. The general project of information model for e-learning environments is presented in Figure 1.

This model consists of: various date models, model of the digital resources, content packing information model and InLoC models. The data models include: Collaborative workplace data model, Collaborative environment data model and Collaborative group data model. The data models are also referred to by technology models. The model can be further developed and expanded with new types of data models, objects and competences. It should be remembered that the design and implementation of a large e-learning platform with advanced services requires the use of different standards. Taking into account such standard as ISO/IEC 9126:2001 Software Engineering - Product quality - Part 1: Quality model, ISO 9001:2008 Quality management systems – Requirements and others, as well as new interactive environments and new technologies greatly expand the model used.

## REFERENCES

- CEN Learning Technologies CWAs, available at http://www.cen.eu/cen/ Sectors/Sectors/ISSS/CWAdownload/Pages/Learning%20Technologies.aspx, (accessed on 15 October 2013)
- CEN/TC 353 Information and Communication Technologies for learning education and training, available at http://www.cen.eu/CEN/ sectors/sectors/isss/Pages/CEN%20TC%20353.aspx, (accessed on 15 October 2013)
- CEN Technical Committees and Workshops, available at http://www.cen. eu/cen/Sectors/TechnicalCommitteesWorkshops/Pages/ default.aspx, (accessed on 15 October 2013)
- CEN Workshop on 'Learning Technologies' (WS/LT), available at http://www.cen.eu/cen/Sectors/Sectors/ISSS/Activity/Pages/WSLT.aspx, (accessed on 15 October 2013)
- CWA 16655:2013 Part 1: Information Model for Learning Outcomes and Competences
- ISO/IEC Information Center, available at http://www.standardsinfo.net/info/ aboutstd.html, (accessed on 15 October 2013)
- ISO/IEC JTC 1/SC 36 Information technology for learning, education and training, available at http://www.iso.org/iso/iso\_technical\_committee.

html?commid=45392, (accessed on 15 October 2013)

- ISO/TC 232 Learning services outside formal education, available at http://www.iso.org/iso/home/standards\_development/list\_of\_iso\_technical\_com mittees/iso\_technical\_committee.htm?commid=537864, (accessed on 15 October 2013)
- ISO/IEC 12785-1:2009 Information technology -- Learning, education, and training -- Content packaging -- Part 1: Information model
- **ISO/IEC** 19778-1:2008 Information technology --Learning. education and training - -Collaborative technology Collaborative workplace -- Part 1: Collaborative workplace data http://www.iso.org/iso/home/store/catalogue\_tc/ model. available at catalogue detail.htm? csnumber=46153, (accessed on 15 October 2013)
- ISO/IEC 19778-2:2008 Information technology -- Learning, education and training -- Collaborative technology --Collaborative workplace -- Part 2: Collaborative environment data model
- ISO/IEC 19778-3:2008 Information technology -- Learning, education and training -- Collaborative technology --Collaborative workplace -- Part 3: Collaborative group data model
- ISO/IEC 24751-1:2008 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Part 1: Framework and reference model, available at http://www.iso.org/iso/catalogue\_detail.htm?csnumber=41521, (accessed on 15 October 2013)
- ISO/IEC 24751-1:2008 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Part 1: Framework and reference model
- Mortimer M. comp. by, 2001: LibrarySpeak: a glossary of terms in librarianship and information management. DocMatrix, Canberra, 2001, 4th ed., p. 96. ISBN 9786610950515
- Przybyła W., Ratalewska M., 2012: A handbook for e-learning courses designers. National Support Centre for of Vocational and Lifelong Education, Warsaw, 2012, p. 13. ISBN 978-83-7789-136-0 [In Polish]

# Annex: List of selected documents published by the International Standardization

#### 1. The documents published by ISO/IEC

ISO/IEC 19796-1:2005 Information technology -- Learning, education and training - Quality management, assurance and metrics -- Part 1: General approach

ISO/IEC 19788-1:2011 Information technology - Learning, education and training -Metadata for learning resources - Part 1: Framework ISO/IEC 19788-2:2011 Information technology - Learning, education and training -Metadata for learning resources - Part 2: Dublin Core elements

ISO/IEC 19788-3:2011 Basic application profile

ISO/IEC 19788-5:2012 Educational elements\*

\* Other parts of the draft ISO/IEC 19788 are still being developed. These :

are:

IS IS	O/IEC 19788-4 O/IEC 19788-6	Technical elements Availability, distribution, and intellectual property
elements		
IS	O/IEC 19788-7	Bindings (RDF, Turtle, RDF/XML)
IS	O/IEC 19788-8	Bindings (RDF, Turtle, RDF/XML)
IS	O/IEC 19788-9	Data elements for Persons
IS	O/IEC 19788-10	Application Profile for Access, Distribution and
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Intellectual Property (WIPO compliant) elements

ISO/IEC 24751-1:2008 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Part 1: Framework and reference model

ISO/IEC 24751-2:2008 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Part 2: "Access for all" personal needs and preferences for digital delivery

ISO/IEC 24751-3:2008 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Part 3: "Access for all" digital resource description

Work on the preparation and publication of new documents are also conducted:

ISO/IEC FDIS 20016-1 Information technology for learning, education and training -- Language accessibility and human interface equivalencies (HIEs) in e-learning applications -- Part 1: Framework and reference model for semantic interoperability

ISO/IEC NP 20016-2 Information technology for learning, education and training --Human interface equivalencies -- Part 2: Template for Specifying Levels of Semantic Unambiguity

ISO/IEC NP 24751-2 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Access for all -- Part 2: Registry

ISO/IEC NP 24751-3 Information technology -- Individualized adaptability and accessibility in e-learning, education and training -- Access for all -- Part 3: Application profile

ISO/IEC NP 29187-2 Information technology -- Identification of privacy protection requirements pertaining to learning, education and training (LET) -- Part 2: Guidelines for information life cycle management and EDI of personal information

ISO/IEC NP 29187-3 Information technology -- Identification of privacy protection requirements pertaining to learning, education and training (LET) -- Part 3: Multilingual Vocabulary

# 2. The documents published by ISO/TC 232 Learning services outside formal education

ISO 29990:2010 Learning services for non-formal education and training -- Basic requirements for service providers

# **3.** The documents published by ISO/IEC JTC 1/SC 36 Information technology for learning, education and training

ISO/IEC 12785-1:2009 Information technology -- Learning, education, and training -- Content packaging -- Part 1: Information model

ISO/IEC 12785-1:2009/Cor 1:2013

ISO/IEC 12785-2:2011 Information technology -- Learning, education, and training -- Content packaging -- Part 2: XML

ISO/IEC 2382-36:2008 Information technology -- Vocabulary -- Part 36: Learning, education and training

ISO/IEC 2382-36:2008/Cor 1:2012

ISO/IEC 19778-1:2008 Information technology -- Learning, education and training -- Collaborative technology -- Collaborative workplace -- Part 1: Collaborative workplace data model

ISO/IEC 19778-2:2008 Information technology -- Learning, education and training -- Collaborative technology -- Collaborative workplace -- Part 2: Collaborative environment data model

ISO/IEC 19778-3:2008 Information technology -- Learning, education and training -- Collaborative technology -- Collaborative workplace -- Part 3: Collaborative group data model

ISO/IEC 19780-1:2008 Information technology -- Learning, education and training -- Collaborative technology -- Collaborative learning communication -- Part 1: Textbased communication

ISO/IEC 19796-1:2005 Information technology -- Learning, education and training - Quality management, assurance and metrics -- Part 1: General approach

ISO/IEC 19796-3:2009 Information technology -- Learning, education and training - Quality management, assurance and metrics -- Part 3: Reference methods and metrics

ISO/IEC 23988:2007 Information technology -- A code of practice for the use of information technology (IT) in the delivery of assessments

ISO/IEC 24703:2004 Information technology -- Participant Identifiers

ISO/IEC TR 12785-3:2012 Information technology -- Learning, education, and training -- Content packaging -- Part 3: Best practice and implementation guide

ISO/IEC TR 24725-1:2011 ITLET supportive technology and specification integration -- Part 1: Framework

ISO/IEC TR 24725-3:2010 Information technology for learning, education and training -- Supportive technology and specific integration -- Part 3: Platform and Media Taxonomy (PMT)

ISO/IEC TR 24763:2011 Information technology -- Learning, education and training -- Conceptual Reference Model for Competency Information and Related Objects

ISO/IEC TR 29127:2011 Information technology -- System Process and Architecture for Multilingual Semantic Reverse Query Expansion

ISO/IEC TS 29140-1:2011 Information technology for learning, education and training -- Nomadicity and mobile technologies -- Part 1: Nomadicity reference model

ISO/IEC TS 29140-2:2011 Information technology for learning, education and training -- Nomadicity and mobile technologies -- Part 2: Learner information model for mobile learning

ISO/IEC TR 29163-1:2009 Information technology -- Sharable Content Object Reference Model (SCORM®) 2004 3rd Edition -- Part 1: Overview Version 1.1

ISO/IEC TR 29163-2:2009 Information technology -- Sharable Content Object Reference Model (SCORM®) 2004 3rd Edition -- Part 2: Content Aggregation Model Version 1.1

ISO/IEC TR 29163-3:2009 Information technology -- Sharable Content Object Reference Model (SCORM®) 2004 3rd Edition -- Part 3: Run-Time Environment Version 1.1

ISO/IEC TR 29163-4:2009 Information technology -- Sharable Content Object Reference Model (SCORM®) 2004 3rd Edition -- Part 4: Sequencing and Navigation Version 1.1

ISO/IEC 29187-1:2013 Information technology -- Identification of privacy protection requirements pertaining to learning, education and training (LET) -- Part 1: Framework and reference model

## 4. The documents published by CEN/TC 353 Information and Communication Technologies for learning education and training

CWA 16655-1:2013 InLOC - Part 1: Information Model for Learning Outcomes and Competences

CWA 16655-2:2013 InLOC - Part 2: Guidelines including the integration of Learning Outcomes and Competences into existing specifications

CWA 16655-3:2013 InLOC - Part 3: Application Profile of Europass Curriculum Vitae and Language Passport for Integrating Learning Outcomes and Competences

#### 5. The documents published by CEN Workshop

CWA 14040:2000 (withdrawn) A standardization Work Programme for Learning and Training Technologies and Educational Multimedia Software

CWA 14590:2002 (E) Description of Language Capabilities

CWA 14643:2003 Internationalisation of the IEEE Learning Object Metadata

CWA 14644:2003 Quality Assurance Standards

CWA 14645:2003 Availability of alternative language versions of a learning resource in IEEE LOM

CWA 14871:2003 Controlled Vocabularies for Learning Object Metadata: typology, impact analysis, guidelines and a web based Vocabularies Registry

CWA 14926:2004 Guidelines for the production of learner information standards and specifications

CWA 14927:2004 Recommendations on a Model for expressing learner competencies

CWA 14928:2004 Review on SIF Infrastructure, Architecture, Message Processing and Transport Layer

CWA 14929:2004 Internationalisation of SIF and harmonisation with other specs/standards

CWA 15155:2004 Adaptation of SIF (Schools Interoperability Framework) Data Model for a European context

CWA 15453:2005 Harmonisation of Vocabularies of eLearning

CWA 15454:2005 A Simple Query Interface Specification for Learning Repositories

CWA 15455:2005 A European Model for Learner Competencies

CWA 15533:2006 A model for classification of quality approach in elearning

CWA 15555:2006 Guidelines and support for building application profiles in e-learning

CWA 15660:2007 Providing good practice for E-Learning quality approaches

CWA 15661:2007 Providing E-Learning supplies transparency profiles

CWA 15903:2008 Metadata for Learning opportunities (MLO) - Advertising

CWA 15966:2009 Guidelines and recommendations for building metadata application profiles for agricultural learning resources

CWA 16076:2010 ECTS Information Package/Course Catalogue MLO Application Profile

CWA 16077:2010 Educational Credit Information Model

CWA 16078:2010 Curriculum Exchange Format

CWA 16097:2010 The Simple Publishing Interface (SPI) Specification

CWA 16131:2010 Europass Diploma Supplement Application Profile of the EuroLMAI

CWA 16132:2010 European Learner Mobility Achievement Information

CWA 16133:2010 Guideliness on a EU Learner Mobility Model

CWA 16385:2012 Interoperability of registries

