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From multimedia to virtual worlds - innovative learning at Slovak University of Agriculture

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Abstract
The project PacAgro (543902-TEMPUS-1-2013-SK-TEMPUS-SMGR) aims to develop the Public Accreditation of Agricultural Programs in Russia. One of the important part in the quality high education represent the didactical tools and methodologies. Multimedia, information and mobile technologies or virtual reality bring new forms of learning materials or assignments, which, besides the fact that are available anytime and anywhere, fundamentally changing the way of education.
Slovak University of Agriculture in Nitra thanks to participation in the several projects supported by European Commission, has implemented innovative methods of education and make the educational process more attractive by using multimedia, mobile technology and virtual reality.
The "FITR – Food Incubators Transforming Regions" comprises unique training curriculum and course materials to successfully establish and manage food incubator hubs to cater for the growing numbers of emerging food entrepreneurs who are in urgent need of a place to produce, learn and grow. It targets community drivers, development agencies and VET bodies.
The "RUBIGAS - Agrobiogas as an alternative source of energy in rural areas", through innovative training materials, transfer of know-how and acquisition of new skills and competencies of farmers and employees of agriculture sector, focuses attention on support educational efforts to disseminate knowledge on agricultural biogas plants and renewable energy sources.
The "MobiVET 2.0 - Mobile Web 2.0 e-Training for Vocational Education Trainers" aims to fill the online training gap between the self-directed learners and VET trainers by developing m-learning 2.0 knowledge and skills of the trainers thus turning them from in-class trainers to skilled online tutors.
The „AVARES - Enhance attractiveness of renewable energy training by virtual reality" aims to create innovative learning methodologies and integrate them with traditional learning. The developed Hybrid Educational Platform combines traditional learning procedures offered to students via LMS Moodle with learning procedures delivered to students in 3D Virtual World.

Key words: *Innovative learning, mobile technology, virtual reality, accreditation*

JEL classification*: I2 - Education and Research Institutions*

1. Introduction

Information and Communication Technologies (ICT) and e–learning tools are well known and there are no actual limits for their technical realization. It is not reasonable in recent time to stick to strictly traditional educational methods, given that introduction of e–learning methods into the teaching process, according to many experimental results, will clearly bring positive results. However, it's necessary to make some rather radical changes in the teaching way:

- **Change in the way of teaching/training.** The traditional teaching model is based on reproduction of teacher's knowledge by students. A student may gain a huge amount of encyclopedic knowledge, but he/she is not able to update it or use it effectively in practice. Current pace of knowledge development and evolvement has as a result that knowledge gained this way doesn't reflect the reality. So, teaching students how and where to get necessary information and knowledge and how to use it, when they really need it, should be the main objective of teaching.

- **Change in the way of knowledge presentation**. Existing ICT tools enable creation of multimedia based textbooks and electronic courses made available on the Internet. Knowledge can now be displayed using multimedia, realistic animations, 3D objects, virtual reality etc. This allows students to gain updated training knowledge from several sources, from any place, at any time and in a more comprehensive way. Such access to teaching/training materials will allow lifelong learning for people without interrupting their work duties. At the same time, number of students using developed courses and thus enhancing their sphere of activities will increase, together with their training effectiveness improvement.
- **Change in learning materials.** At the present time books are not the only source of knowledge. Availability of electronic learning materials and complete courses continually increases. Internet connection of training institutions and smart devices allow access to various electronic learning sources at any time and from any place.
- **Change the role of teacher**. From knowledge provider, the teacher should be transformed into an e–learning methods and materials integrator. However, creation of e-learning materials and courses requires a tight cooperation of several experts – a teacher, a graphic designer, a programmer, an analyst etc.
- **Change of students' responsibility for knowledge level**. Today, the teacher is the person holding the responsibility for students' knowledge level. In the e-learning era, the student would be the only person responsible for his/her knowledge level.

Despite the fact that the role of information and communication technologies is important for online learning, it is impossible to ignore the pedagogic point of view. It will never be possible to carry out the training process only through ICT, with no teacher participation. Even though the new technologies will significantly change teacher's role in the learning process, they will never substitute for the teacher's personality. Teacher's role will always be motivating students, advising them in their study progress, giving them vision and meet his/her social role.

2. Innovative technologies for education

2.1. Multimedia technologies in education

"Multimedia" is often a subject of ambiguous interpretation, as we can see it in citations from a variety of resources. According to the Webster's Desk Dictionary (Merriam-Webster), multimedia indicates using more media simultaneously. Jonassen (Jonassen, 1996) defines multimedia as integrated media such as text, images, animations, audio and video. Encyklopedica Britannica (Britannica, 2016) defines multimedia as several computer systems allowing usage and manipulation with several types of media such as text, audio, video, computer graphics and animation. The Columbia Electronic Encyclopedia (Encyclopedia, 2016) defines multimedia in computers as the software and applications using audio, 2D and 3D graphics, photos, animations and video. Introduction of term "interactive" by the TechTarget (TechTarget, 2016) means a qualitative progress – TechTarget defines multimedia as more than one competitive media while the media might be interactive, e.g. operated by means of voice, mouse, touchscreen, text etc., with the possibility of videoconference. Švejda (Švejda, Palková, & et al., 2006) takes multimedia as an automated process, containing at least three mutually independent usable information channels, leading from the learner to the system or vice versa, while at least two of them lead from the learner and at least one is used for transfer of learner's reaction to the system.

Creation and distribution of electronic training materials is an important part of all e–learning. Electronic training materials are applications combining text interpretation and multimedia. It requires synoptic processing, intuitive control and easy access to online and offline information.

Electronic training materials can be distributed through the Internet (online) or data media such as CD/DVD, USB flash, memory cards (offline).

Creating high quality multimedia materials requires good knowledge of necessary hardware and software technologies. It's also necessary that the content of individual materials be professionally prepared, therefore a tight cooperation of teacher (or other expert in the field) and graphic designer or programmer is necessary.

2.2. Mobile Learning (m-learning)

Mobile Learning (m-learning) referred also as "anytime, anyplace learning" (Caudill, 2007), (El-Hussein , 2010) has evolved with the introduction of mobile and hand-held devices, such as mobile phones, laptops, netbooks and tablet PCs, in teaching and learning, together with broadband and wireless data transmission. This greater connectivity creates opportunities for flexible, collaborative modes of learning, whilst supporting stronger links between learning at work, in the home, at school or in the community (Figueredo, 2015).

From this point of view, mobile learning allows truly anywhere and anytime, personalized learning, which through nonconventional devices and methods make traditional lessons or courses more attractive. Using mobile communication - for young people native forms of communication - helps learners and teachers to recognize and build on existing basic literacy skills and can help deliver and support literacy, numeracy and language learning.

At last but not least, mobile learning helps to combat resistance to the use of ICT by providing a bridge between mobile phone literacy and PC literacy.

In present time a great variety of mobile computers and devices are available. Laptop computers outnumber desktop computers, while notebook computers, tablets and cellular "smart" phones are considered to be the most important hardware items used for m-learning activities.

Mobile devices can bring users following advantages (eschoolnews, 2014):

- spontaneity - learning activities take place when the learner feels ready, or can be used to fill "dead time";
- immediacy - learning becomes possible at the point of need, regardless of location;
- increased access - learning resources can be accessed from the workplace and in the field, while traveling, and during classes or lectures;
- portability - communication with peers and tutors, and the capture, storage and retrieval of information in multimedia formats are possible from one device at any location.

2.3. Virtual reality

"Virtual World" term is used to describe digital spaces that can be explored from within, where users can navigate through, interact with objects, other users and soft bots. Users can exchange information via text, audio, still images, animation and video. Usually, the user's presence is facilitated by an "avatar" - a digital 3D object that is used to represent the user. This representation is chosen by the user who may decide if his/her virtual identity has any real-world resemblance.

The currently popular virtual worlds are three-dimensional (3D) computer rendered environments, which can be accessed over a network, usually via Internet, populated by users in form of avatars, which interact with the simulated environment and other users. These virtual worlds have been moved beyond gaming and chat environments and have been transformed

into powerful communication and education tools. The sensory immersion and the way of communication with other users make them a feasible alternative approach to tasks such as, distance learning and training, world-wide communication and collaboration. The number of private and public virtual world users grows steadily, from 300 million users world-wide in 2008 to forecasted 1 billion users in 2017 (Council, 2016), populating existing and new virtual worlds that are constantly being developed.

According to Gartner Research (Gartner, 2015) statement dated 2008: "Public virtual worlds, which are suffering from disillusionment after their peak of hype in 2007, will in the long term represent an important media channel to support and build broader communities of interest".

Virtual worlds are becoming a major technology, useful for teaching, learning, research and collaboration. Virtual worlds constitute a growing online space for collaborative play, learning, edutainment and work.

3. Innovative learning: examples of good practice

3.1. FITR project

The Food Incubators Transforming Regions (FITR) project brings together partners from Northern Ireland (Banbridge Distinct Council and Canice Consulting), Slovakia (Slovak University of Agriculture and New Edu, n.o.), Netherlands (Stitching Business Development Agency) and Irish partners Momentum Marketing and Roscommon LEADER Partnership.

Project objectives

The project started in September 2015 and over 24 months, FITR plans to achieve in four regions - in Ireland, UK, Slovakia and Netherlands, four key deliverables:

- Through a Triple Helix leadership network to establish four sustainable, sector focused Regional Partnerships to study and capture best practice in the development of Food incubators and.
- Create and publish a "The Essential Guide to developing a Regional Food Incubator" to focus on "how-to" strategies for food hub establishments and operations that are based on successful models operating in other regions and new concepts from the US (the market leaders in food incubators).
- Create and publish a course curriculum, guiding Vocational Education and Training practitioners on the topics and skills most needed to establish and manage a Food incubator.
- Develop an intensive blended learning "The Essential Toolkit to develop a successful Food Incubator" course based on open education resources, targeting regional change makers in local government, development agencies, communities, businesses, not-for profits and others interested in establishing food hubs.

While across whole European Union many communities and local government bodies see merit in developing food incubators, they lack the skills to realise same. The FITR toolkit and online training course cover different formats of food incubators:

- regional value-added food processing centres,
- shared-use community kitchens,
- shared-use agricultural processing facilities, which are designed for use by farmers for collective grading, processing and packaging of farm produce or other commodities,
- mobile incubators that can go to primary producers.

Rather than solely focusing on the final target group, partnership harnesses the knowledge triangle of actors working in food, regional marketing, and wider economic development. This

enables us to ensure the relevance and provide greater strategic focus to our training course, but also to create a more enabling environment for food incubators to be adopted as a driver of food entrepreneurship in the EU. This will be achieved though the creation of 4 Regional Partnerships.

FITR Course Curriculum & Content

At the end of the project FITR Course Curriculum & Content will be available in 3 languages (English, Dutch and Slovak) and based on the following principles:

- comprehensive and relevant course curriculum and content;
- comprehensive and relevant set of open educational resources, which together comprise the course content, but which can also be used independently.

Course curriculum comprises 6 modules and covers following topics:

- Creating possibilities for food incubation in the Region - a series of modules to train participants how to review of the potential of the sector through learning how to conduct a robust and credible feasibility analysis, the research tools to establish need and methodologies to harness support, identify suitable premises, how to technically assess and SWOT each building and negotiation skills to acquire the building at preferential rates.
- Different Models of food incubators - training to allow participants to synthesize best practices models and assess best fit for themselves; regional value-added food processing centres; shared-use community kitchens; shared-use agricultural processing facilities, which are designed for use by farmers for collective grading, processing and packaging of farm produce or other commodities; mobile incubators that can go to primary producers premises and act as in situ production units.
- Food incubators business strategy - the nuts and bolts of running a food incubator, licensing options for operators, kitchen management protocols, adding value to your incubator e.g. shared sales & distribution platforms.
- Stimulating demand - tools to develop a pipeline of new food entrepreneurs in your region through Pre-Incubation supports and mechanisms, creative marketing of the resource.
- Accessing resources - training in innovative access to public finance, crowd funding potential and attracting corporate sponsors.
- Connecting to collaborations & communities - the potential of co-working, new methodologies for creative collaborations, parameters of same and success tools.

The course will be taught in a blended learning format and duration of each module represents 25- 30 hours of self-guided online and classroom based learning with:

- Classroom training course designed for use by HEI - VET and Business Support providers. Learning will embedded through self-assessment exercises (leading to a course certificate), peer to peer communications and setting up an ideas portal for participants who may like to collaborate with other emerging food incubator developers.
- Mobile and online learning resources for individual private study.
- Training notes for HEI-VET and Community Business Support providers to integrate our course and open educational resources into their offerings.

3.2. RUBIGAS project

With the aim to bridge the gap between the theoretical aspects of interest about the sustainable development, especially biomass/biogas exploitation in agrosector, its practical delivery and training needs, RUBIGAS Needs Analysis has been designed. Based on the outcomes of the realized Need Analysis the form of the RUBIGAS training materials are processed through

usual technologies – the LMS Moodle support, using multimedia elements and Web 2.0 technologies.

From the educational activities point of view respondents highlighted the needs of formal and informal education in the field of renewable energy, with emphasis on the current, brief and accurate information, supported by case studies and examples of good practice. Suitable forms of education were mentioned in particular e-learning courses supported by "live" case studies and presentations of examples of good practice.

Problematic factors of education and practical implementation of the acquired knowledge, respondents identified primarily lack of time and lack of really valuable training courses/activities. Moreover, respondents emphasized the necessity to support these educational activities –during present inefficient agricultural production in most of countries farmer doesn't have time for fulltime education.

Based on the results of Needs Analysis, interactive learning materials have been developed. These are published through traditional learning platform – Learning Management System Moodle (Fig. 1). In the frame of the project following modules have been developed:

- General,
- Biomass,
- Agro-biogas plants,
- Geothermal energy,
- Solar energy,
- Water energy,
- Wind energy.

Fig. 1 Examples of learning materials in RUBIGAS learning platform

3.3. MobiVET 2.0 project

The MobiVET2.0 (MobiVET2.0, 2015) project aims to fill the online training gap between the self-guided learners and VET trainers by developing mobile Web 2.0-based [16] knowledge and skills of the trainers thus turning them from in-class trainers to skilled online mobile tutors (e-tutors). The project identify the obstacles to mobile e-tutoring and address and alleviate these problems by demonstrating existing online learning and tutoring applications and practices based on Web 2.0 technologies to trainers showing their pedagogical and didactical benefits.

The project shows how the Web 2.0 technologies may be used simply by non-IT experts, using sample courses and guidelines developed during the project.

With the aim to evaluate developed methodology how to create and use mobile courses from both the teachers' and the students' perspectives were developed seven m-learning courses. These mobile courses are available at MobiVET2.0 platform [15]. Four of them were developed with the aim to introduce sample of m-courses for teachers:

- Emotional Intelligence in the Workplace,
- Green Office (Fig. 2),
- Intercultural Skills,

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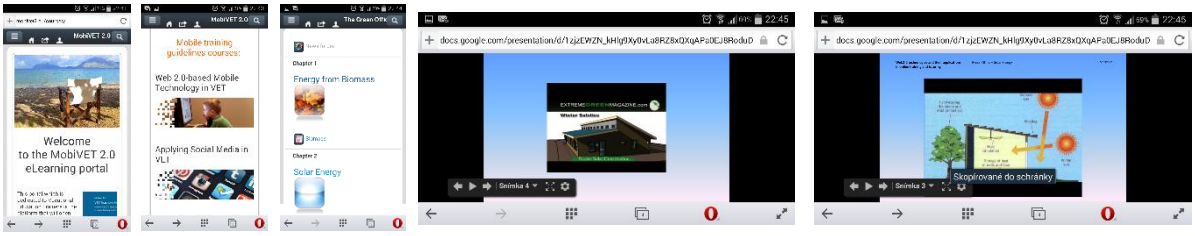
- Leadership Skills.

The last three courses are targeted primarily to improving the skills of teachers/trainers in the field of m-learning and developing of m-courses:

- E-learning practices in VET,
- Applying social media in VET,
- Web 2.0-based Mobile Technology in VET.

The project therefore broaden the e-skills and competencies of European VET practitioners (teachers, trainers and tutors) and help develop adequate online training practices for effective distant tutoring of lifelong self-learning activities at the workplace and on the go without time and distance barriers. This way the project supports the development of innovative ICT-based tutoring services, pedagogies and practices for lifelong learning.

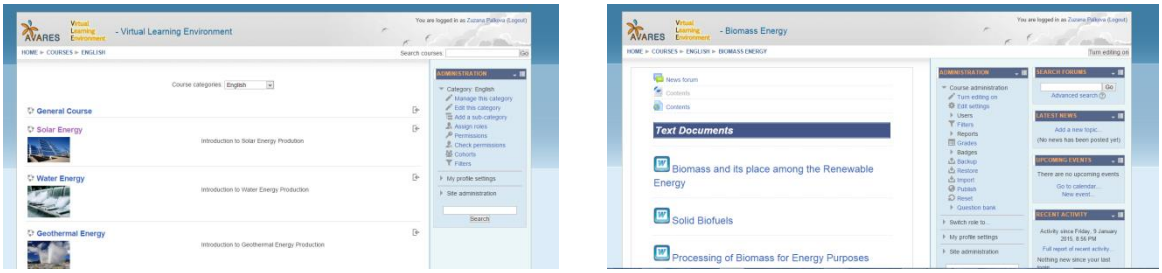
Fig. 2 Examples of multimedia learning materials in m-learning courses



3.4. AVARES project

The project aims to create a 3D virtual learning environment and multimedia leaning materials for vocational education and training in the field of renewable energies. A hybrid education platform developed in the project combines traditional educational practices, provided via learning management system (LMS) Moodle (Fig. 3) and a virtual world (3D RES Park)

Fig. 3Virtual learning environment combines the advantages of LMS Moodle and virtual reality



LMS Moodle focuses on the learning process management and delivers to students a theoretical background for the RES field. Students can explore and learn about RES domain through 5 courses (Fig. 3):

- Solar Energy,
- Water Energy,
- Wind Energy,
- Geothermal Energy,
- Energy of Biomass.

Students can register to the Virtual Learning Environment (VLE) platform and create personal accounts. After that, they can anytime access the platform with their credentials. The course material mainly consists of multimedia materials that the students can download and study on their own pace. Learning materials also include textbooks, web-pages, animations and videos.

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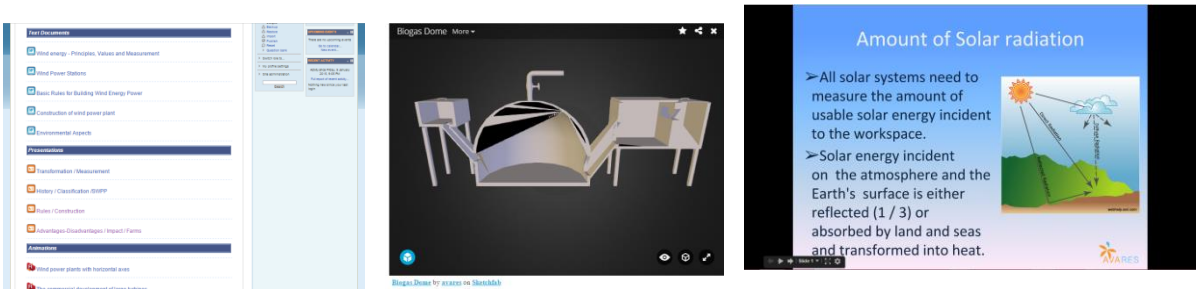
At the Fig. 5, some examples of multimedia content in the Virtual Learning Environment are illustrated.

Fig. 4 Examples of multimedia content in the Virtual Learning Environment



The 3D Virtual RES Park offers an environment that allows shifting the traditional educational process (book/textbook) to the new way of learning that is interactive and more visual (Fig. 5). Virtual reality offers an attractive and effective way of learning where students can learn through experimentation and interactions in the virtual world.

Fig. 5 The virtual world gives students the ability to communicate with other students or interact with the objects

The AVARES 3D RES Virtual Park consists of:

- The 3D Auditorium - trainers giving lectures in the 3D Auditorium will be able to load specific presentations from the VLE or even upload their own slides.
- Sub-Areas dedicated to each course - for each one of the five main learning topics (Solar, Water, Wind, Geothermal, and Biomass) there is a designated area inside the world with the corresponding training material along with interactive 3D models that will help them comprehend the presented topics.
- Classrooms/Meeting Rooms - these rooms can serve as meeting areas for project partners and as classrooms for small groups of students as well.

The learning materials stored in the VLE (Moodle) are available in the 3D RES Virtual Park as well. Specific activities and presentations can be displayed as posters or boards at various areas of the 3D Virtual RES Park. Trainers/teachers can give their lectures in the 3D Auditorium where they are able to load learning materials from the VLE or even upload their own slides.

4. Summary

At the present time multimedia, information and mobile technologies or virtual reality actively intervene into the educational process. As technologies change the society, they change the education and training systems as well. This article presents a way how to use multimedia, virtual reality, Web 2.0 technologies and innovative methods of learning and shift them efficiently and attractively from the traditional book/textbook paradigm to a new way of the digital learning content in the education process.

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Lifelong Learning Programme

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