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IT TOOLS IN BUSINESS EDUCATION

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edited by

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Preface

Nowadays nobody has any doubts about the usefulness of IT tools for the educational purposes. The development of the Internet and other information and communication technologies has completely changed the approach to training people and transferring knowledge. New forms of learning, like e-learning, blended learning, Web 2.0, a variety of simulations and other modern approaches are now undoubtedly integrated with the educational processes. This book presents selected issues on the application of IT tools in widely-defined business and management education.

The first chapter is devoted to the use and development of e-learning systems in educational projects. It generally presents some practical methods of their use in the education processes. The chapter further analyses the impact of different e-learning systems on improving the quality of education.

The second chapter describes online application and e-learning in the competence-based management in public administration organizations. Presently, all the organizations need to raise the level of organizational competence with appropriate training and education. This chapter presents a system for the evaluation and development of managerial competence in the Police compatible with the latest models and technologies.

The third chapter is devoted to multimedia in teaching economics and management in higher education. The application of multimedia in education is not a new issue, but is intensity is definitely growing. The aim of this chapter is to present the results of research concerning actual use of multimedia in teaching economics and management.

In the fourth chapter one can find information on the development of economic education through mobile technology. The aim of this chapter is to present new technology capabilities to increase effectiveness and efficiency of education basing on knowledge assets.

The fifth chapter presents interactive prototypes in teaching user-centred design and business process modelling. This chapter describes experiences gathered during the use of interactive prototyping in two areas: design of user interfaces for a touch screen information kiosk and interactive prototyping of business processes. Such skills are valid for professionals dealing with design of IT systems.

In the sixth chapter the concept of nomadic learning is discussed. This chapter discusses the outcomes of two projects related to introducing mobile learning environments in the Polish-Japanese Institute of Information Technology PJWSTK in Warsaw, Poland.

In the next, seventh chapter the issues of teaching management skills to software development teams through the lean start-up methodology are discussed. Managerial skills today are nowadays crucial not only on managerial positions. Software development teams are also required to deliver customer value and apply client orientated approach.

The eighth chapter is on developing competences of IT project managers using simulation games. The purpose of this chapter is to demonstrate the possibilities of education of project managers through the use of simulation games.

The ninth chapter presents cloud solutions as a platform for building advanced learning platform that stimulate the real work environment for project managers. As the author of chapter wrote, improving skills of managers and executives require that during the transfer of knowledge it is necessary to use tools and solutions that are (or will be) used in real world environments. That is why the presentation of practical knowledge on IT tools is so crucial for future managers and employees.

The tenth chapter concerns knowledge engineer, which is more than only a technical position. The chapter describes the concept of educating Knowledge Engineers at the Faculty of Management and Economics. The graduates of this Faculty are well-educated professionals, often working in SMEs or starting their own business.

The last, eleventh chapter is devoted to the application of IT tools in educational project dissemination. This chapter describes these issues on the example of the INNOCASE Project, funded with support from the European Commission under the Lifelong Learning Programme and with Polish Ministry funds for Science in 2013-2014 granted for international co-financed project realization. The chapter presents innovative approaches (based on IT) to educational project dissemination. It can be a source of inspiration for managers leading other educational projects.

We are deeply convinced that the book on “IT Tools in Business Education” will be useful to all kinds of professionals and trainers dealing with business education at its various levels. It provides many interesting insights into contemporary issues connected with the application of information technologies in training successful managers and employees.

Editors: Małgorzata Zięba & Artur Ziółkowski

CHAPTER 1

The use and development of e-learning systems in educational projects

Krzysztof REDLARSKI*

1. Introduction

Many universities in Poland have a problem with ensuring quality in education processes. Strong competition in the education market forced universities to use new methods and tools to support traditional forms of learning. Among the many forms of teaching, a significant group of products used to support the education processes are the, so-called, e-learning systems.

The chapter discusses the outcomes of a study conducted among two Polish universities in the use of e-learning systems. The core analysis includes a comparison of the use of two e-learning systems: Ilias and Moodle. It shows practical methods of their use in the education processes and describes how different e-learning systems impact on improving the quality of education at universities.

2. E-learnig systems

The development of systems supporting the traditional teaching processes was initiated with the emergence of the computer, and later the Internet. Presently, most educational projects conducted at universities in Poland are supported through the use of various IT technologies. Starting with the basic communication tools, such as websites,

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material repositories, and ending with courses using the latest Web 3.0 technologies (Kurilovas, Kubilinskiene, Dagiene, 2014).

The currently dominating, among Polish universities, classes of IT systems supporting remote learning processes are:

- LMS (Learning Management System) – training management systems that mainly allow reporting, administration and monitoring of learning progress, teaching material management, permissions management, and user course enrollment.
- LCMS (Learning Content Management System) – training content management systems that, beyond functionality available in the LMS, have the ability to create, edit, support and manage didactic content. They give a possibility to control the process of creating didactic content and archiving it (Caniëls, Smeets-Verstraeten, van den Bosch, 2007).

The educational platform is the element integrating the tools for remote education, which in most cases allows for modular expansion of content available for students. In addition, it performs as a communication medium between the lecturers and students, through which it is possible to carry out remote learning via the Internet (Graf, List, 2005)

3. The use of e-learning systems in education

With the development of IT, the process of teaching at universities has inevitably changed. Greater availability of broadband Internet, and mobility of new computing equipment, meant that systems supporting the processes of education at universities began to rapidly develop (Garrison, Vaughan, 2007). This contributed to the increased use of a variety of educational platforms that began to support remote learning processes (Lopez Perez, Ariza Rodriguez, 2010; Roceanu, 2008). Currently, majority of Polish universities are implementing, or implemented, various e-learning platforms, offering a wide range of solutions for different demands (Cohen, Nycz, 2006; Bednarek, Wolodko, 2007). However, despite their widespread use, voices may be heard criticizing little usefulness of this type of solution in practical terms.

Professional literature contains several definitions of the e-learning term, containing its, more or less, detailed interpretations. However, with regard to the chapter, it is assumed that e-learning transcribes as "instruction delivered on a digital device such as a computer or mobile device that is intended to support learning" (Clark, Mayer, 2011). This definition indicates the primary goal of e-learning, which is to support remote teaching through the use of modern IT and the Internet. Thus, in relation to the presented definition, it is particularly important that educational projects implemented at Polish universities were characterized by high product usability (Sikorski, 2012; Redlarski, 2013), in this case is an educational portal, as well as to effectively achieve their

goals. The observed technological progress makes the pace of change taking place in the use of IT raised new challenges for the effective use of IT tools in the e-learning process (Stromme, 2008). A contemporary university student is a person mostly proficient in the use of new technologies, who can make use of mobile devices and the Internet (so-called, digital natives) (Palfrey, Gasser, 2013)

The development of remote teaching methods results mainly from human nature, which drives towards satisfying the basic needs, distinguishable among which is the need to learn, the so-called Lifelong Learning (LLL). Currently in Poland there are several institutions developing this form of teaching, they include (among others):

- Remote Learning Center of the Warsaw University of Technology [http://www.okno.pw.edu.pl/]
- Open and Multimedia Education Center of the University of Warsaw [http://kampus.come.uw.edu.pl/]
- Remote Learning Center of the University of Slask [http://www.cko.us.edu.pl/]
- Remote Learning Center of the Gdansk University of Technology [http://cnm.pg.gda.pl/]
- New Media and Remote Learning Interdepartmental Division of the University of Lodz [http://nno.uni.lodz.pl/]

Among most frequently used teaching methods in Polish universities, Blended Learning is the most dominant (Mayer, 2009). It is a merger of traditional teaching model with remote learning. It this model, the student takes part in both traditional lectures at the university, as well as has the possibility of using learning content available via the Internet.

The most dominating education platforms used among Polish educational units are (Zieliński, http://www.elearningonline.pl/):

- Moodle [http://www.moodle.org] – a platform allowing for more than 1500 practical applications in Poland. It possesses broad capabilities for system administration and content management provided on the platform. It was based on the GNU General Public License (GPL).
- ILIAS – [http://www.ilias.de] - the platform is popular with more than 18 000 installations worldwide, it is also used at public and private Polish universities. It is characteristic for its modular design, giving the possibility of expansion and customization to one's own needs. It was also based on the GNU General Public License (GPL).

In addition to the e-learning platforms mentioned above, other teaching platforms are also in use (e.g. Claroline, OLAT, Dokeos, ATutor) (Graf, List, 2005). However, due to the inability to carry out research at universities that use them, they are not discussed in this chapter. A separate group of this type of products are also the

commercial learning platforms, yet, due to the necessity of additional costs, they are relatively rare at Polish universities.

4. Advantages and disadvantages of using the e-learning platforms exemplified on universities

The aim of the study was to analyze the usage of two e-learning platforms used at Polish universities, and their impact on the quality of the teaching process. Two educational platforms were examined, both mentioned in the first part of the chapter: Ilias and Moodle. As a result of usage observation, and based on the opinions expressed by the classes participants, an identification of advantages and disadvantages for the use of such tools in the learning process was conducted.

First to be examined was the Moodle platform, implemented at a state university and made available to teachers to use in the teaching process (Fig. 1).

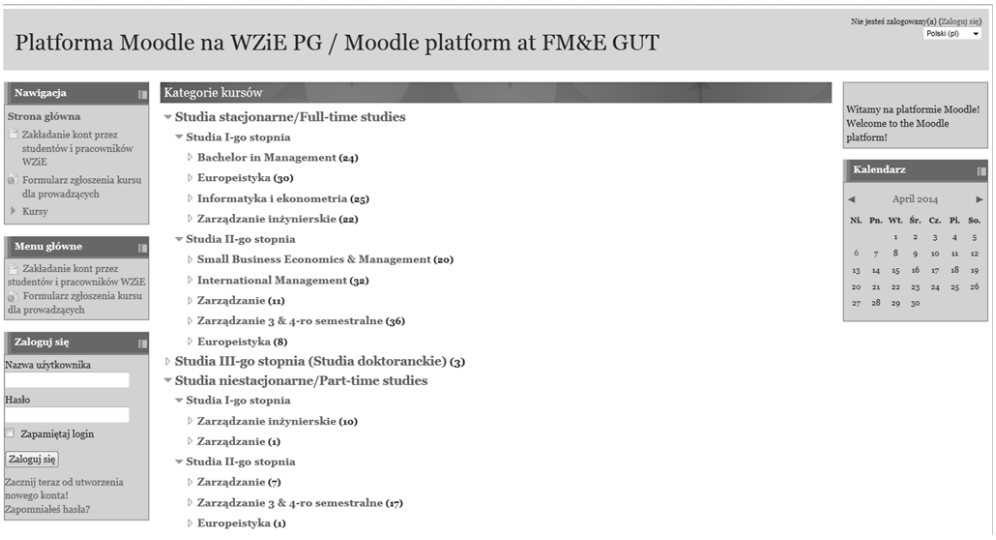

Fig. 1. Moodle platform main page.
source: http://moodle.zie.pg.gda.pl/

The platform contained about three hundred courses designed to support the teaching process in selected university classes. Vast majority of the courses corresponded with the program of the studies.

The conducted case study analysis allowed the following conclusions to be drawn on the benefits of using Moodle in the tested environment (Table 1).

Table 1. Advantages of Moodle platform used at a state university.

ADVANTAGES	DISCRIPTION
Availability	Uploaded materials are available 24 hours a day, 7 days a week, to allow an individual choice of study time.
Mobility	Uploaded materials are available at any location equipped with an Internet access. There is a wide range of possibilities to take part in the course (e.g. via computer, laptop, smart phone, or a tablet), which are currently very popular among students.
Customization	Content published through the platform is easily customizable, and offers many possibilities to use various forms of presentations. The platform is equipped with numerous tools and functionalities, which effective use may increase the attractiveness of the courses.
Ease of communication	There is a possibility of fast communication with the participants of the course outside the designated class hours. This makes it possible to inform them of any changes related to the realized course.
Learning scope standardization	The division of the course material into individual thematic blocs helps to define the scope of knowledge required by the lecturer to master. Course objectives are thus easily measurable, and there is no risk of, so-called, "lecture-content chase" - e.g. in the absence of sufficient time during the class.

Based on the case study, conclusions were drawn regarding the disadvantages of the use of Moodle in the studied environment (Table 2).

Table 2. Disadvantages of Moodle platform used at a state university.

DISADVANTAGES	DISCRIPTION
Insufficient user interaction	Course materials have a low interaction value with course participants. In most cases, they are solely documents published in the e-learning platform, which, in this case, plays a role of a material repository, rather than a fully interactive course.
Lack of integration with other systems	The proposed solution does not have the possibility of integration with other IT systems at the university. Students are forced to use multiple systems simultaneously in order to obtain additional information.
High material development expenditures	Appealing form of the course requires training people responsible for publishing content on the platform, and requires a considerable amount of time to prepare them.
Motivation	The use of e-learning form of courses as a teaching method requires greater discipline than in case of stationary studies, and is dedicated to those with high motivation to learn.
Extended learning time	Time required to master the material content with e-learning courses is definitely longer than the traditional form of teaching with direct access to the teacher.

Second of the evaluated platforms was the Ilias, implemented at a private university, and made available to teachers to be used in the teaching process (Fig. 2).

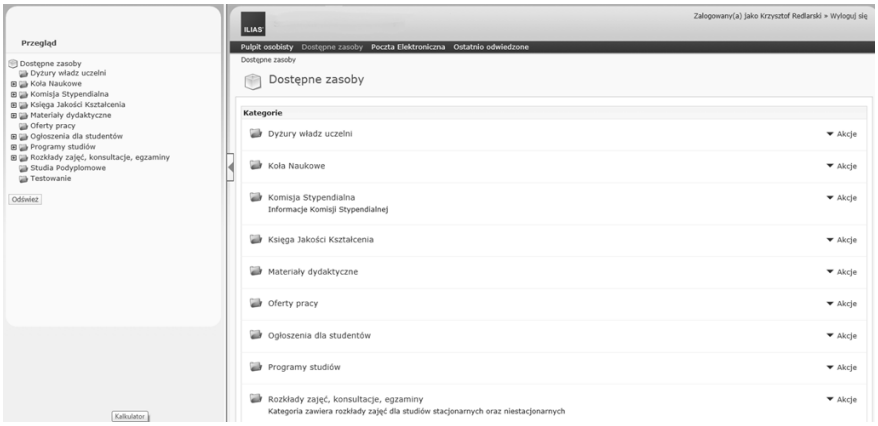

Fig. 2. Ilias platform main page.
source: https://ilias.ssw.sopot.pl

The Ilias platform included several dozen of courses designed to support the learning process at the university. In addition, it was integrated with university organizational units, offering its users a variety of additional information. Amongst the courses offered by the platform, the majority were materials related to the lectures realized within the program of the studies.

The case study analysis, involving a five-year hands-on use of the platform, enabled the following conclusions to be drawn regarding the advantages of using the Ilias platform in the studied environment (Table 3).

Table 3. Advantages of Ilias platform used at a private university.

ADVANTAGES	DISCRIPTION
Integration	The platform was integrated with various organizational units of the university (i.e. deanery, academic circles, scholarship committee, etc.), which contained relevant information from the students perspective. This allowed platform users to additional information related to the university operations, ie. timetable regarding the lecturers availability, teaching materials, deanery announcements, job offers, and additional classes offers.
Availability	Identical to the case described for the Moodle platform
Mobility	Identical to the case described for the Moodle platform
Customization	Identical to the case described for the Moodle platform
Ease of communication	Identical to the case described for the Moodle platform
Learning scope standardization	Identical to the case described for the Moodle platform

Based on the case study analysis, conclusions concerning disadvantages of using the Ilias platform in the examined environment were also formulated. The analysis allowed the identification of identical defects of the platform Ilias, as in the case described for the Moodle platform, i.e.:

- Lack of sufficient user interaction,
- High material development expenditures,
- Motivation,
- Extended learning time.

The only exception in this case is not listing the Ilias platform disadvantage defined as: "Lack of integration with other systems". Its absence is resulted by the integration of the tested platform with other organizational units of the university.

The results of the study did not confirm the general concerns about the lack of direct contact with the course user, low reliability whilst contacting the lecturer, and also a lack of sufficient control over it. The usage of the e-learning platforms probably had an influence on the results of the research. In both cases, it was used in the, so-called, Blended Learning.

5. Conclusions

The conducted observational studies allowed for comparison of two popular e-learning platforms used at Polish universities. The chapter describes the development of such systems in Poland and identifies the advantages and disadvantages of their use from the perspective of the main participants in educational projects, namely teachers and students. Undoubtedly, in both cases, their impact on the quality of the learning process was positively assessed, both by university staff, and stationary and extramural students. It is also worth mentioning that the vast majority of Polish universities has, in their IT resources, ready and implemented product solutions that allow them to conduct e-learning courses in any desired form.

Analysis of the results of the research also allowed the following conclusions to be drawn:

- E-learning platforms currently used among Polish universities are used primarily as a tool to support the traditional form of learning (Blended Learning).
- Files are the dominant form of material presentation made available through e-learning courses. This causes the vast majority of e-learning platforms to be used only as a material repository, which does not meet the role of an interactive course.
- The use of a selected educational platform (Ilias, Moodle) had no direct impact on the quality of published educational materials and the form of their presentation.

- The use of a selected educational platform (Ilias, Moodle) had no direct impact on the satisfaction level among participants of the educational projects.
- The use of e-learning platforms was positively received in the studied cases by both students and university employees.

From the perspective of further development of e-learning systems in Poland it is therefore important to ensure the possibility of increasing the attractiveness of courses within the used educational platform. In both studied cases, one of the obstacles to achieving this goal was the absence of an appropriately implemented system of training people responsible for establishing new courses. Lack of sufficient knowledge and skills to build attractive forms of presentation materials - often advanced skills - reflected in a lack of development of interactive and multimedia forms of didactic materials. Indeed, according to the studies (Sikorski, 2012), interaction with the end user has become a decisive factor of high usability, and also a factor in the success of the educational project.

A further important element in the way of enhancing the attractiveness of the e-learning courses is the implementation of an appropriate system of university staff motivation. The system should encourage the improvement of the material content presented by the educational platforms. The use of an interactive form of presentation is, in fact, a time-consuming process, and requires a considerable amount of time from the lecturer - especially in the initial phase of the project. Therefore, without the implementation of effective motivational tools and employee support by the university, this goal will be hard to achieve.

An additional important element in the use of e-learning platforms is their integration with other university IT systems. During intensive development of the use of electronic platforms and digitization of Polish universities, there is a need to develop coherent tools that would enable a comprehensive support for all processes carried out at a university. Due to the integration of all IT systems, students and university employees should be able to remotely attend university matters by the Internet. This approach should, in a long term, contribute to the growth of interest of a still relatively new and not fully developed form of education, as for Polish conditions.

The presented research results possess certain limitations, which include the representativeness of the sample. In addition, they only represent the perspective of a student, described as the end user of the course, and of the teacher, described as a person simultaneously conducting and being responsible for the e-learning course. The research results do not, therefore, include other participants of the project, for whom the perspective of using the e-learning platforms might be significantly different. This group primarily includes technical staff, responsible for the maintenance of the technical infrastructure, and university authorities. Due to this, the study did not include, for example, the impact of the use of e-learning tools in cost reduction of stationary teaching, the costs of ensuring adequate technical infrastructure, and the necessary costs for

of e-learning tools functioning. Although, as research show (Rossett, 2002), the factors above are important from the perspective of assessing the suitability and the use of e-learning in educational projects.

An unquestionable advantage of the presented chapter results from the studies conducted on the actual educational projects. During the studies, there was a constant and direct contact with individual course participants who had the opportunity to use the previously mentioned e-learning tools. The results cover a period of five years of Ilias e-learning platform usage, and one year of Moodle platform usage.

To conclude, the author predicts that the future educational projects will continue to develop in the direction of complete isolation of student from the teacher, the so-called d-learning (distance learning). This may result from a general tendency to increase the flexibility of the teaching process and an individual approach to the student. Widely observed market globalization, ease of Internet access, combined with the ability to share disk resources (cloud computing), should be the factors contributing to further development of precisely this form of education. However, with relation to universities, in order to increase the quality and participation of various forms of remote learning, the change should be foremost done to the form of the content published as part of the offered courses. E-learning materials, available as part of the evaluated courses, must include a greater interaction factor with the training participant.

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Summary

The chapter introduces the problem of usage and development of e-learning systems among Polish universities. Easily accessible internet and IT development led to changes in education. Through the use of IT tools, e-learning has become an increasingly popular form of education. Presently, majority of Polish universities use an e-learning system of their own choosing designed to support the didactic processes. The goal of the chapter is an assessment of the popular e-learning systems used in selected group of universities, overview of their advantages and disadvantages, and pinpointing causes of problems associated with their use. A case study, carried out within the research among the main educational projects participants, took into consideration the opinions of users of different e-learning systems. Solutions suggested within the chapter should primarily be useful to decision-makers responsible for development and implementation of new e-learning systems among universities. The conclusions might prove helpful in taking the right decision to effectively use the new IT tools. The chapter also highlights the existing opportunities and obstacles of e-learning system development, as their main goal is to shift the form and increase the attractiveness of lectures, and, at the same time, increase the effectiveness of the learning process.

CHAPTER 2

The online application and e-learning in the competence-based management in public administration organizations

Beata BASIŃSKA*, Izabela WICIAK**

1. Introduction

A characteristic phenomenon of modern organizations is their professionalization and the consequent demand for high levels of organizational competence. Up to date, the expectations of competence had not been so widespread. However, in recent years it has been shown that more rapid growth of organizations may be dependent on the competence of employees (Oleksyn, 2010). The aim of competence-based management is to improve the efficiency of the organization and increase the value of human resources. It is focused on improving the quality of human resource management in the organization. However, its main aim is to achieve business goals (Draganidis, Mentzas, 2006).

Competence is a combination of the skills, knowledge, attitudes and motivation which determine the effective or exceptional performance of the tasks related to a particular position. Thus competences can be acquired, developed and shared by them (Janjua, Naeem, Kayani, 2012). Whereas a competency model is a set of competences and associated behavioural indicators which has a specific structure and describes the effectiveness of people in an organization. It should be tailored to the needs and

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requirements of the whole organization and to the people who would use the model, taking into account the specificities of the different functional areas of the organization (Whiddett, Hollyforde, 2003).

The effectiveness of competence-based management depends on several characteristics: a model should be appropriate to the organization, it should be connected with other systems, and managers should be involved in the process of its creation. A competence model can enhance the organization's current functioning, as well as improve its performance in the future challenges and changes (Gangani, N., McLean, G. N., & Braden, 2006). The implementation of modern online instruments seems to be a necessity (Schmidt, Kunzmann, 2006). This allow a more consistent and, above all, more efficient management of the organization.

The outcomes of the implementation of competence management are:

- competence-based job descriptions, or competence profiling;
- definition of the critical competences access to appropriate organizational level, needed to efficient recruitment and selection;
- succession planning;
- assessment of the competences of individuals and groups within the organization;
- an objective process for staff evaluation;
- better planning and evaluation of the effectiveness of training and development;
- enhancement of the job promotion and career development, and an increase in self-awareness of employees;
- improvement of communication within the organization (Draganidis, Mentzas, 2006; Zawadzka, 2010).

The use of competence management fills a gap resulting from concentrating on the tangible results of the work without paying attention to the importance of quality and the way in which people perform tasks and achieve goals (Letkiewicz, Szankin, 2013).

This issue is particularly important in public administration organizations where the results of work are not always linked to the goals of the organization. It also happens that the expected standards are not met. The quality of service and customer satisfaction are business goals in these organizations (Horton, Hondeghem, Farnham, 2002). The Police is an example of a public administration organization which protects internal security and takes care of the safety of citizens (Luen, Al-Hawamdeh, 2001). The aim of the chapter is to present a project of competence-based management in public administration using the example of the Polish Police. The project joined management knowledge, management instruments, and an online application. In this way the synergy effect can be achieved and the efficiency can be enhanced.

2. Methodology

2.1 The aim of the project

The main aim of the project was to create a modern computerized system for the assessment and development of managerial competences of Police executives. The project was focused on increasing the efficiency of those who manage managers and improving effectiveness in fulfilling the potential of Police employees.

The project was carried out by a team of police specialists and an external company, ALTA, in the years 2010 - 2013. The second author of the study was an active member of the project team. The project was founded by the National Centre for Research and Development No. OR00002611. The connection of knowledge and experience of experts from the organization and the external agency's knowledge and experience in designing competence models and developing IT application produced a significant synergy.

2.2 Project structure

The system consists of a competence-based model reflecting the requirements and specificity of the organization, competence profiles of management positions, and an online application together with its substantive content, tools and methods to assess the competences. As part of the system, training programmes have been developed, including e-learning training courses which enhance the development of key management competences, as well as training courses for users of the system *the Academy of Members*. The final result of the project is a computerized system for the assessment and development of managerial competences in the Police.

2.3 Procedure and methods

The project involved three groups of activities. Firstly, a model of management competences was developed along with instruments supporting their assessment (guides for competence-based interviews, a 360 degree feedback, sessions for Assessment Centres and Development Centres, psychometric questionnaires for testing competences of managers). Secondly, online application for the system assessment and development of managerial competencies, were designed, an online platform and instruments were implemented and their testing were conducted. Thirdly, questionnaires and training modules for workshops (police training courses managerial competences development workshops and a *Development Academy*) were developed and implemented on an e-learning platform.

The competence-based model using a expertise and participation method was built. The expert method is performed by experts and external specialists. Whereas the participation method includes employees to competence-based system design (Rowe, Frewer, 2000).

In addition, the following methods were used: the method of critical events, interviews based on the Repertory Grid Interview method (Duda, 2011; Hunter, Beck, 2000), a competence-based interviews (Kessler, 2006), the 360 degree feedback, and the Assessment Centre and the Development Centre (Vloeberghs, Berghman, 2003).

3. Results

3.1 Competence map

In order to develop a model of managerial competences in the Police a method of benchmarking of competence models was used. Such a model is applied in police forces in different European countries. The combination of information from different sources containing knowledge, experience and best practices in building competence models has resulted in the development of a coherent competence model for managerial staff in the Polish Police.

Existing documents (personnel records, job descriptions, legal acts and operating procedures) were analysed in order to understand the specifics of the organization and to identify existing standards for their evaluation. Then, the model of interviews with employees was developed, in accordance with the principle of engaging employee participation in the implementation of changes. The methods of critical events and Repertory Grid Interview were used.

Such interviews allowed the collection of a significant number of examples (over 1000) of specific behaviours associated with effective operation in management positions in the Police. Interviews were conducted in several centres with persons occupying managerial positions.

This was followed by a classification of data obtained during the interviews. In the first stage unclear descriptions were rejected, the complicated ones were simplified, and duplications were excluded. Subsequently, selected behaviours were categorized in related groups, and names were given which best reflected the behavioural content. These were grouped together to form clusters of competences. The result created a list of competences, together with corresponding behavioural indicators which consist of the positive and negative behaviours reflecting a particular competence. The behavioural indicators were clear, unique, and independent.

In this way, the initial version of the *Competence Map* was developed. This map consisted of the names of competences, definitions and sets of behavioural indicators, together with the scale for competence assessment. In addition to the project team, experts from the organization were invited to verify the initial version of the map of managerial competences. As a result of discussions, the final version of the *Management Competence Map* was produced. The structure of the competence map includes the following clusters of competences: cognitive, social, leadership, personal and effectiveness ones. This version of the map has been implemented in the IT application.

3.2 Competence assessment

The next task was to prepare guides to conducting competence interviews for each competence and evaluating these using the 360 degree method. A handbook *The Guide for the competence interview* and a checklist were dedicated to improve the process of assessing competence. The concept of competence interview assumes the use of a sequence of questions: questions about *activities* (examples of specific past experiences and behaviours in these situations), questions concerning *intentions* (identification of the causes of behaviour), and questions about *reflection* (determination of perception and self-evaluation of effectiveness). These last were used to enable identification of the factors that contributed to gain success and produce behaviours that can be modified in the future. The guide for the interviews included: the competence map, a structured methodology for conducting the interview, a model of observing, recording, classifying and evaluating behaviours, and a checklist for the competence interview.

The next step was to prepare the content for a computerized system of 360 degree feedback of competence. This was implemented in the IT application. In this respect the following were defined:

- appearance of the application screens,
- templates for invitations and reminders, sent as e-mails,
- questionnaires for self-assessments and for the reviewers,
- the manual contents,
- algorithms for counting and presenting results,
- report templates and content of reports.

These elements were entered into the application and allowed to run an online evaluation.

Subsequently, assessment tasks were designed together with detailed documentation which allows the design and conduct of assessment or development sessions concerning the evaluation and development of competences identified at the earlier stage of the project. One day assessment centre sessions were conceived in order to diagnose selected competences.

The following types of tasks were developed together with the necessary documentation: group discussion with no roles assigned, simulated internal and external conversations, an individual analytical task. Qualitative and quantitative data was presented in the form of text, graphs and tables.

In the next stage methodology was developed consisting of a competence matrix - tasks and psychometric tests for the assessment of selected managerial competences. A *competence matrix* is a matrix showing the connections between the different competences and the tasks that allow them to be verified. It enables better management of tasks with the greatest efficiency in relation to the competence assessed. The final result was consisted of online tools and procedures for the assessment of managerial competences. In contrast, psychometric tests, the popularity of which is constantly

growing, are tools used in the processes associated with managerial staff in organizations. They are used to identify preferences, abilities and skills, both of employees and job applicants. They use standardized measurements, are objective, and their outcomes are characterized by a high degree of reliability and validity.

3.3 Training and development

An integral part of the competence management system are training courses and workshops for developing managerial competence. Their goal is the proper preparation of managers to accomplish this task. Therefore, the training programmes were developed with materials to facilitate conducting of workshops for managers.

First, a decision was taken according to the topics of the training, the assignment of competences to individual workshops, and to the schedule. During the meetings, the workshops and their documentation was developed by project team. Particular attention was paid to the structure and quality of these documents. For each workshop the following were developed: the workshop programme with individual themes, topics and expected delivery time; manual for the coach, in which all the exercises and tasks to be performed during the workshop were described along with PowerPoint training materials, training materials for participants and individual workshop exercises.

In parallel, training courses were conducted within the framework of *the Academy of Members* for those signing up to the project in the following areas: the underpinning theory and methodology (e.g. a module from the competence model) of the assessment tools and the development of competence (competence interview, the Assessment Centre and the Development Centre, providing feedback, psychometric tests and the interpretation of results) and management of the technical aspects of the developed application.

3.4 Online application

In order to create effective instruments for competence-based management a draft online application was prepared for the online evaluation and development of skills. Then a platform for online testing was implemented.

The implementation of a platform for testing makes it possible to: manage account users, create a database of participants, send individual invitations to an assessment, carry out online evaluation, generate individual and collective reports, and provide e-learning. The following learning modules for development workshops were prepared and implemented within the e-learning platform: *communication skills* (active communication, influencing, making an impression), *conflict resolution, cooperation and coping with stress, decision-making* (decision-making and creativity), *team management* (motivation, feedback and constructive criticism, leadership).

To use the system it is necessary to *login* with your e-mail address and password. Participants receive an access code together with an invitation to the test (by e-mail).

Access passwords are valid for a period of time as determined by the administrator. The connection applies SSL protocols to ensure security.

The *end-user panel* provides information about logging into the system, the number of tests completed since last login, and the number of days remaining to the expiration of the password. In addition, a help tab allows the user to administer the documentation provided on the platform and their correspondence. Below this is access to the most frequently performed search operations. One can go to the following bookmarks: participants, tests, projects and competence-based models.

The *participant panel* contains logon information, announcements and a testing schedule. After logging in to the system a participant dialogue panel is displayed with information about log on and the protection of personal data. From the operations bookmark participants can edit their personal information and go to the *my account* window. Announcements are the point of contact between the system administrator and participants. The diary provides participants with key dates and information. In the central window of the screen participants can see the tests to which they have been invited.

The system also includes the following supporting and training materials: an interview guide, customized reports generation, and e-learning. *The interview guide*: a document is generated for each competence that contains the name of the competence group, individual competence name, its definition, behavioural indicators showing positive and negative behaviour, the scale of assessment, and a checklist for the competence interview. *Individual Report*: for each test a report of result is generated with a commentary and guidance to support the development of the given competence. The 360 degree report contains an introduction, a description of the competence assessed and scale of assessment, response statistics, and a general and detailed evaluation. *E-learning*: a panel of the participant invited to e-learning includes the personal information, *my account* section, and the status of particular stages and the degree of their implementation. Each lesson begins with the presentation of the topic. The lesson content includes definitions and examples, not only in text form, but also through charts and graphical applications.

4. Conclusions

The system presented for the evaluation and development of managerial competence in the Police is a solution compatible with the latest models and technologies. The implementation of a coherent model of competence will enable the organization to use a single, common set of decision criteria for the implementation of key processes associated with the selection and development of managers. At the same time it will ensure a common understanding of the criteria at different levels of the organization, and the precise definition of work standards in different positions.

The effect of the application of the evaluation and development of managerial competences enables organizations to obtain objective information about managerial strengths, as well as to identify key areas requiring development activities. Such knowledge can increase efficiency in exploiting the potential of current employees, conscious and deliberate planning their further development in accordance with the needs and long-term strategy of the organization. Implementation of the solutions developed should also have a positive impact on the motivation and commitment of employees, and on creating a positive image of the organization to the outside (Luen, Al-Hawamdeh, 2001; Olszewski, 2010).

It should be emphasized that the model presented has been placed on the platform and awaits a decision for application across the entire organization. However, without technological support in the form of online application, achievement of the aim of the project could be jeopardized. A platform for online testing and e-learning will enable a holistic execution of the project at implementation phase across all organisational units. The online application allows the barriers of time and location to be overcome. In conclusion, only if the organization maintains a coherent strategy will this project be fully implemented. Without a platform for online testing and e-learning it would not be possible to implement the system as designed at the same time and across all units. Such a solution would enable better control over the use of the system, and also more rapid response to potential issues.

Risks that may arise during the operation of the competence-based management system are related to technological and human factors. Firstly, the limited access to the Internet can foster user dissatisfaction. Secondly, resistance to the new system should be expected from some users. Despite the potential hazards, the system of assessment and development of managerial competence may result in a breakthrough in improving work efficiency. Integrating modern knowledge with the IT platform will increase the quality of work and realise the potential of human resources, thereby improving the quality of services. This synergistic effect will favourably impact citizens who are clients of public administration organizations.

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Summary

The integration of effective management of work-related processes and utilization of human resources potential leads to the development of organization. The purpose of this chapter was to examine how the principles of competences-based management can be introduced to enhance organization's effectiveness in human resources management. A model of assessment and development of competences-based management, embracing an online application and e-learning has been designed. The project refers to managers of the Polish police.

The project involved three groups of activities: a model of competences-based management, online application for the system assessment and development of managerial competencies, training modules on an e-learning platform. The model of competences-based management using the online platform integrates the human resources management with the results of work and the accomplishment of key processes.

CHAPTER 3

Multimedia in teaching economics and management in higher education

Igor GARNIK*

1. Introduction

Teaching methods involving multimedia are well known and used over a hundred years. Also the multimedia has been already evolving for decades. There is probably no medium that would not be used for educational purposes. The aim of this chapter is presenting the results of research concerning actual use of multimedia in teaching economics and management at two Polish technical universities as well as highlighting students' expectations regarding teaching methods based on multimedia. In early 1900's most of the media used in schools were visual media such as films, slides and photographs (see: Reiser, 2001; Saettler, 1968). In 1920's and 1930's, thanks to technological progress educational aids are enhanced by audio. The development of radio contributed to the use of broadcasting for educational and instructional purposes. It was similar with audio recordings, used both as a soundtrack for the films and as an independent medium. The first school that uses two-way radio for distance learning was established in 1951 in Alice Springs in Australia. It was the only optimal method of teaching school children living on a huge area of Australian Northern Territory. The development of television has allowed the immediate transmission of audio-visual content. Previously used films required time-consuming processing before they could be used in class.

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The 1952 begun with formation of a network of educational television channels in the United States: in 1960, there were already more than 50 educational TV channels (Reiser, 2001). Educational television has been commonly used around the world and this medium is used in many countries to this day. TV technology was used not only to broadcast educational programs. CCTV (Close Circuit TV) systems were applicable also for some kind of lessons. These systems consisted mainly of TV camera and the TV receiver or monitor and were used, for example, for magnifying and displaying details which were difficult to present without this aid.

Undoubtedly, the implementation of computers in schools and universities constituted a revolution in the use of media for educational purposes. Initially, computers were used mainly to learn programming and IT applications. However, later with technological progress they began to be used for the presentation of multimedia content in other subjects. The main advantage of computer applications is their interactivity, which had not been offered by previously used media. Very quickly attention was paid to new opportunities, which contributed to the emergence of many new proposals for the use of computers in education, such as educational games, simulations, animations explaining various phenomena as well as tutorials, that might be done by the students without direct teacher's supervision (see: Psotka, 1982; Tucker, 1990).

The raise of the Internet began another revolution. Internet primarily was a source of information only. However, by increasing link speeds and advances in technology, it has become a platform for multimedia and web applications. The main advantage of today's Internet is that its content and services are available for the users through different devices, various operating systems, and at any time or place. This independence of Internet creates new opportunities for the use of multimedia, in particular, the use of media for educational purposes.

Media today are ubiquitous. For many users, especially for young people (students and schoolchildren) they are a part of natural environment. Therefore, it is obvious that the use of multimedia in teaching is much more intense than before the 'era' of computers and the Internet. There has already been conducted a lot of research devoted to the use of multimedia in education (Andresen & Brink, 2013; Dan, Feldman, & Serpanos, 1998; Dwyer, 1993; Lambert & Cuper, 2008; Reisman, 1991). Some of them focused on the use of computers (Selwyn, 1997; Setzer & Monke, 1989), others related to Internet itself (Solomon & Schrum, 2007; Sparrow, Liu, & Wegner, 2011; Tuovinen, 2000), and others to a specific age group of learners: for example, children (Warschauer & Ames, 2010) or students (Frand, 2000; Gabriel, Campbell, Wiebe, MacDonald, & McAuley, 2012; Liebowitz & Bland, 1993; Mayer & Anderson, 1992; Selwyn, 1997). However, as many studies show institutions responsible for curricula and their content very often have no idea how to effectively take advantage of new opportunities (Pelgrum, 2001; Thomas, 2011). A great example here could be the failure of the One Laptop Per Child (OLPC) program which included teaching children from the poorest regions of the World (Cristia, Ibarrarán, Cueto, Santiago, & Severín,

2012; Kraemer, Dedrick, & Sharma, 2009; Warschauer & Ames, 2010; Warschauer, 2006).

Most studies focuses on learning outcomes with the use of multimedia, while less concern on the future of media in education and on the expectations of learners. Due to the focus of this chapter, the scope of sources discussed later will be limited to the use of multimedia in courses taught at universities.

2. Students' characteristics and expectations

Today's students are part of generation called Millenials or Generation Y – in contrary to the name of previous Generation X (which incidentally includes their parents and much of their teachers). What differs these two generations and has a significant impact on their mentality is that the Generation X grew in the Industrial Age, while the Generation Y in Information Age. Another term describing this generation is Digital Natives (Prensky, 2001), as they were born in the age of ubiquitous digital surroundings. These terms refer to young people born between 1980 and 1994 (Weiler, 2005) and for that reason relate to current students of universities.

The today's students may be characterised by the following statements (Frand, 2000):

- *Computers are not technology* – because the technology is treated as something innovative that did not exist before; but computers existed;
- *Internet is better than TV* – the Internet not TV is primary source of information, news, movies, etc.
- *Reality is no longer real* – due to new opportunities information in digital form can be easily manipulated: e.g. you cannot be sure if the person you are chatting with (or even talking to) is that he/she claims to be, or that the photography you watch is authentic;
- *Doing rather than knowing* – in many disciplines a half-life of information is very short, therefore "the ability to deal with complex and often ambiguous information will be more important than simply knowing a lot of facts or having an accumulation of knowledge";
- *Using Nintendo (i.e., gaming) over logic* – deriving from games "trial-and-error" method of learning and reasoning is perceived by the students as much efficient than "traditional" methods based on an analysis of all available information;
- *Multitasking is a way of life* – it is normal to young people to make dozen of actions at the same time: e.g. watching a movie, writing an SMS, reading post on an Internet blog etc.
- *Typing is used rather than handwriting* – for young people typing is natural way of writing; it is easier to manipulate the text: e.g. to correct spelling or copy and paste a phrase;

- *Staying connected is important* – "advanced telecommunication connectivity is a natural part of living for information-age students [...] The idea of not being in touch anyplace, anytime – even in the middle of a classroom or a movie theater – is unthinkable";
- *Zero tolerance for delays* – as the information in the Internet is accessible 24x7 in the same way students expect any actions they desire to be done immediately;
- *Consumer/creator is blurring* – it is very difficult to distinguish who is the creator (i.e. owner of intellectual property) and who is the consumer, when it is easy to copy and share any kind of creation.

Thomas (Thomas, 2011) mentions further that students:

- "constitute a largely homogenous generation and speak a different language vis-à-vis digital technologies, as opposed to their parents, the 'Digital Immigrants';
- learn differently from preceding generations of students;
- demand a new way of teaching and learning involving technology."

Frand (Frand, 2000) concludes that it is not sufficient to only change technology for transferring the knowledge, because students expect also different methods and forms of teaching including access to learning materials and courses anytime and anyplace. Technology may be the facilitator here, but conceptual change in education services is necessary. In a similar vein, his observations expressed Solomon and Schrum (Solomon & Schrum, 2007):

"We can take advantage of the features that new tools offer and tap into students' natural affinity for these tools in order to create learning experiences that expand their worldview and enhance what they learn. Specifically, the features are interconnectedness, immediacy, interactivity, communications, and community. These are the very features that keep global businesses competitive and workers in jobs. [...] Using collaboration and communication tools with educational methods that also promote these skills – such as project-based learning – will help students acquire the abilities they need for the future. [...] Students cannot master 21st-century skills unless their teachers are well trained and supported in this type of instruction."

The above findings show that students are expected to apply in the process of learning the latest technology, including a wide range of multimedia. However, it is necessary to examine whether these expectations are the same for each subject included in the curriculum.

3. Current research

To determine students' expectations regarding the use of multimedia in the classes, in particular concerning economic subjects, a survey was conducted among students of two engineering universities. It included 116 students of Management specialization at Gdańsk University of Technology (GUT) and 6 students of Information Technology

(IT) specialization at Polish-Japanese Institute of Information Technologies (PJIIT) in Gdańsk. The participants are the students finalizing their education. They were asked about their experience and expectations concerning saturation of multimedia use in education process.

The survey included three questions:

- Q1: Do lecturers and teachers use multimedia in their lectures or classes?
- Q2: How useful are multimedia in teaching at universities?
- Q3: Is the multimedia usage sufficient?

Each of the questions asked separately for each group of subjects taught in the university. Distinguished here were the following groups:

- mathematics,
- physics,
- foreign languages,
- IT & CS,
- engineering courses,
- economics,
- management,
- humanities.

Management students at GUT noticed that teachers very rarely use multimedia during classes of economics (Fig.1). Slightly better is the situation at management subjects. As might be expected, multimedia are used most intensively in the teaching of foreign languages, IT and engineering subjects, while the least – in case of humanities. It is surprising that in mathematics, the use of multimedia is marginal.

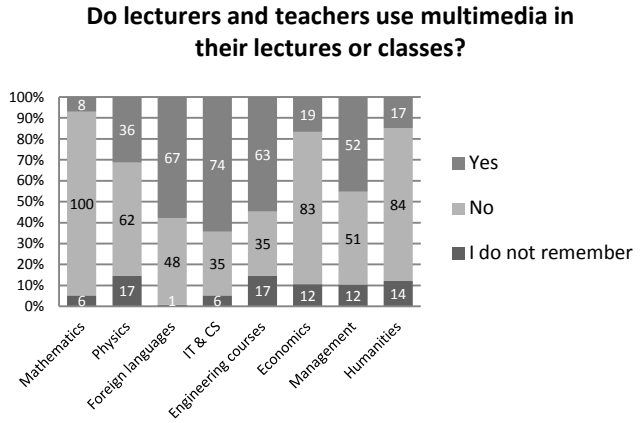

Fig.1. Use of multimedia in courses at GUT

To compare, the same question was asked students of PJIIT (see: Fig.2). The results are similar to those of GUT, however, the use of multimedia in general is more intensive.

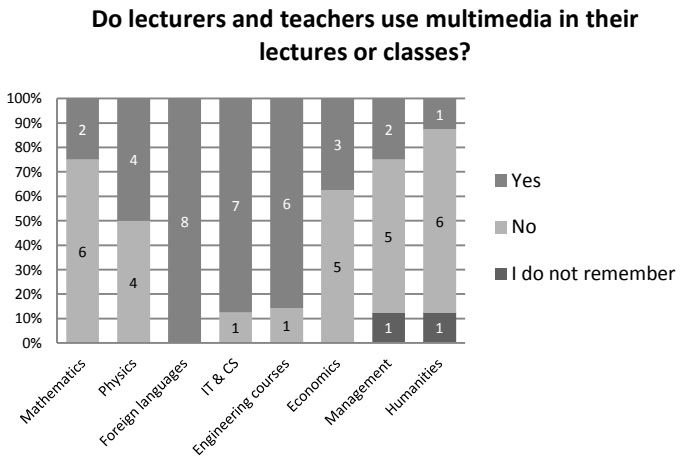

Fig.2. Use of multimedia in courses at PJIIT

Next, the participants were asked about the usefulness of multimedia in teaching particular group of subjects where the courses included multimedia use. Students of management (Fig.3) found to be most useful to use multimedia within the IT and CS courses, foreign languages, engineering courses and management. In case of mathematics and humanities, the same number of respondents found multimedia useful as unsuitable. Only one student of GUT claimed that multimedia used in two of the courses were confusing.

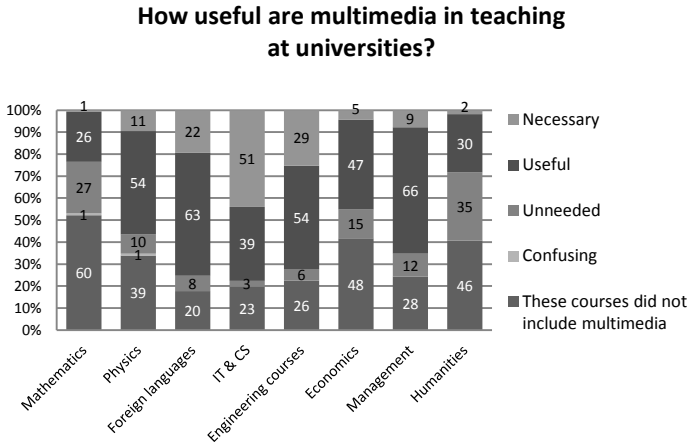

Fig.3. Usefulness of multimedia in courses at GUT

Students PJIIT paid more attention to the usability of multimedia (Fig.4). However, for some respondents, multimedia used in subjects unrelated to their field of study were unnecessary.

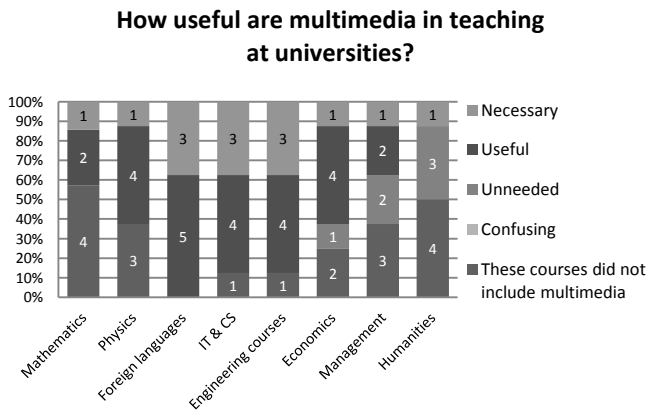

Fig.4. Usefulness of multimedia in courses at PJIIT

In both cases, data distribution displayed on Fig.3 and Fig.4 correlates with the use of media in particular courses (compare Fig.1 and Fig.2). On one hand, it might legitimize slight saturation of media in some courses. However, on the other hand, the attitude of students may be just a result of not using the media in specific courses. To explain this doubt the students were asked one more question.

Fig. 5 shows that GUT students are expected to increase the use of media in respect to almost all of the subjects, in particular to technical subjects and courses directly related to the field of study (i.e. economics and management). Only a small percentage of the respondents were of the opinion that the media should be used less.

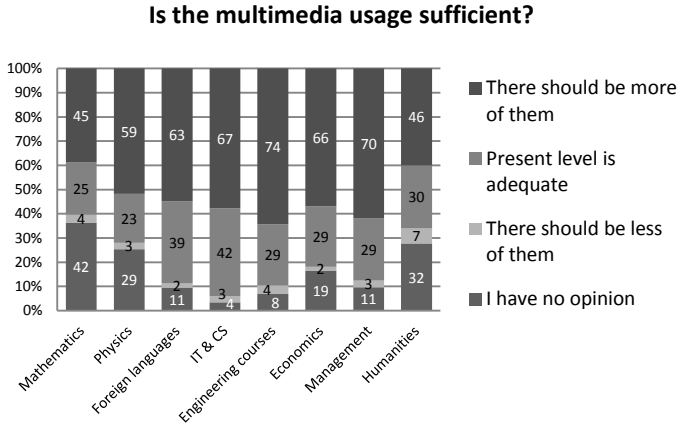

Fig.5. Students' expectations relating to multimedia use in courses at GUT

On the other hand, students PJIIT argued for increasing the number of media only for core subjects and physics. As could be expected, in case of IT students the interest in greater use of media with regard to the economics and management courses was rather insignificant.

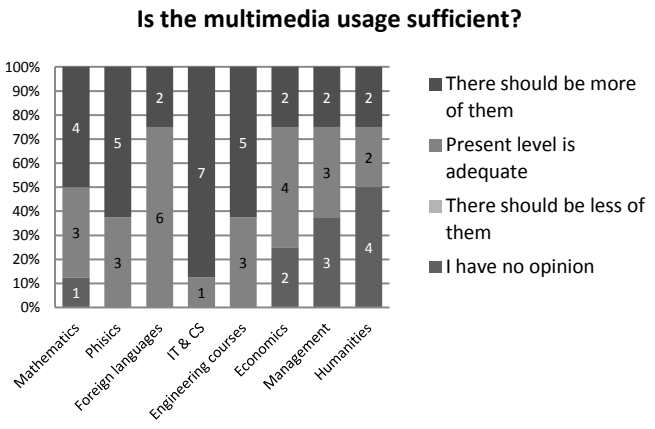

Fig.6. Students' expectations relating to multimedia use in courses at PJIIT

The survey also allowed for comments sharing. This provided some valuable insights that are listed below:

- *Multimedia allow students to better understand complex processes and theories.*
- *Multimedia should be used as much as possible! They help explore the subject and explain more than hundreds pages of text, complicated scripts or unreadable „cartoons".*
- *Multimedia is very rarely used and even if so they are often of a poor quality. It is surprising that during each class a projector connected to a computer is used, on which most often static slides appear, functionally not differing from the clichés of epidiascope.*
- *The absence or low level of use of the multimedia results from lack of familiarity with multimedia applications and devices among lecturers.*

4. Conclusions

Although results of the survey discussed in this chapter relates to a relatively small group of students of two different universities, one can argue that similar expectations as those highlighted here, have most of Polish students. Therefore this study allows for drawing the following conclusions:

1. Students demand multimedia contents, especially in the subjects related to their main field of study. Multimedia is perceived by them as very helpful in the learning process. Moreover, multimedia are more attractive for them than the traditional teaching methods.
2. Current multimedia saturation during the classes is lower than expected by interviewed students. High expectations of students on the level of use of media are probably due to the fact that in everyday life - also (and especially) outside the university - young people are surrounded by media. Therefore they expect that the educational process will be heavily saturated with media as well.

3. Teachers use multimedia at an insufficient level which should be increased. This situation is often due to the fact that most teachers have neither the tools nor the skills to create multimedia educational materials. On the other hand, among teachers - particularly those with higher academic degree – it can be observed the reluctance to use "novelties" and preference toward rather more traditional forms of lectures and exercises. The third reason may be the lack of both understanding and interest in students' expectations by teachers.
4. Universities should better understand students' needs and it should be reflected in their curricula. The use of multimedia in all areas of life is seen as modernity. It is difficult to imagine some of them without media. Therefore, institutions that want to be perceived modern must adapt to this trend. This concerns not only occasional use of multimedia, such as promotion campaigns, but also media wide introduction as educational tools. In the era of high competition at the education market, the use of modern teaching methods based on media can be crucial.

With new technological capabilities multimedia undergoes continuous evolution. It induces a change in the students' expectations in relation to the teachers, teaching methods and the universities as a whole. It gains importance during the 'era' of strong competition between universities. Therefore, in order to ensure the highest quality of education it is necessary to modify the content of the courses – taking into account the intensification of the multimedia use to meet the students' needs.

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Summary

This chapter discusses the current status of multimedia usage in teaching of economics and management at Polish universities. It also exposes students' expectations toward the level of modern tools and methods in educational materials.

In order to investigate this problem at Polish universities, the author conducted a survey among students of two technical universities in Gdańsk: Gdańsk University of Technology (GUT) and Polish-Japanese Institute of Information Technologies (PJIIT). Students were asked how much the media are now being used during the lectures and exercises they attended. The classes were divided into several groups: mathematics, physics, foreign languages, IT & CS, engineering courses, economics, management and humanities. Particular attention was paid to the use of multimedia in teaching subjects related to economics and management. While in the case of students of PJIIT, it was not very important to use multimedia during these classes, GUT students found it as the key issue. Such results could be expected, because the first group consisted of computer science students, while the second one – of management students.

In both cases, students emphasized that media are very useful in teaching, particularly in the teaching of the core subjects. Due to the opinion of most students, multimedia should be more intensively used in the teaching process. Some students pointed out that many teachers do not have the competencies needed to create multimedia teaching materials.

The overall conclusion of the study is that universities should be better prepared to meet the needs of students who expect more intensive use of modern technologies in learning process and want to receive educational materials in multimedia form. Therefore, in the era of strong competition changing universities' approach in the education market seems to be inevitable.

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CHAPTER 4

Development of economic education through mobile technology

Marcin KOŁACZ*, Izabela RICHTER*

1. Introduction

Education has always been crucial in human life and so it was economy. In the era of information and globalisation it has become even more important as knowledge is one of the most worthy resource. And, as it is, everybody is supposed to get all needed information and use it exactly in the most effective way. The problem is the amount of information in the era of internet that should be selected to be usable for the owners. That is the reason why the way of teaching should be changed. The authors focus on multimedia issues related to teaching economics at a pre-college/undergraduate level in Poland. Teachers are not only to teach any more. They are rather to be tutors. It includes permanent studies on how to teach economics, what tools can be used to teach economics and the outcomes from economic education at the pre-college level. Nowadays, students do not expect teachers to be the source of information as they can find most of it in the internet or books. They are rather supposed to teach how to select the information and use it in proper way. That can be the impact of teachers in economic classrooms nowadays.

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2. Knowledge management in Polish education system

What is more the knowledge students can and should use in practical way. It would be the best change in the educational system. It is true due to secondary and high school education, too. Although, both levels seem to be different, the authors can observe similar issues due to their objectives. Autonomy in the market model of coordination of the educational system is based on different assumptions (Clark, 1983; Eicher, Chevailler, 1992; Białecki, Dąbrowa, Szefler, 1994). Teaching and research are not public goods but a commodity. The level of schools varies, and their reputation influences their possibility of attracting resources – students, good staff, research orders. It is relevant as "many authors came to the conclusion that most of the decisions concerning teaching, curricula, research topics and methods are made by individual faculty members (Van Vaught, 1989; Kerr, 1982; Białecki, Dabrowa, Szefler, 1994). What is more changes in educational system are expected by entrepreneurs and students who "pursue different objectives: to participate in research work, to acquire a good knowledge in a specialized field, to deal with fields of knowledge that match one's talents; to graduate with good grades; to become an educated person, to get professional training" (Portele, Huber, 1983; Białecki, Dabrowa, Szefler, 1994). It is especially crucial for Polish youth. In Poland higher education is still treated as prestigious, although high level of unemployment even among graduates create lack of trust that diploma can guarantee necessary competences and good career at contemporary labour market (Jastrząb-Mrozicka, ed. Białecki, Sikorska, 1998).

However, the education system has been transformed for many years but the speed of changes happening at education and labour market is extremely difficult for experts and teachers to be successful. Taking students' future employment possibilities into consideration due to didactic materials they should focus on practical venue of knowledge which is also students' expectations. The education system should involve mulitidisciplinary projects and well knowledge management including team working. It is challenging to create tools supporting all the expectations. One of the solutions making the aim be closer is new technology. However, technology itself may be only didactic tool. Its effectiveness bases on a person who uses the technology due to their knowledge, experience, creativeness and open–mind enough. (Zając, 2011)

The authors want to present a mobile application created to teach economy and fulfil some competence and skills creating expectations. The base of the application is education programme for secondary schools students. Using the form of application makes learning more interesting for the youth comparing to traditional didactic tools used by teachers at schools, nowadays. Research made by D. Kwiatkowska, M. Dąbrowski (Dąbrowski, Kwiatkowska, 2012) on group of 561 students from Polish secondary schools in 2012 proved that most wanted activity due to new technology in their

education system is developing the multimedia tools, such as presentations, films, simulations, and educational games.

It responds to another crucial issue as science popularization is. The way as young people are involved in science issues in schools will determine their attitude to researching in future (Kozłowski, ed. Białecki, 2003). Moreover, while using the mobile application students use knowledge at maths, abstract thinking, IT. In the era of knowledge learning is no longer transferring but creating knowledge (Kozłowski, ed. Białecki, 2003). That is why there is also possibility to involve teamwork while using the application on-line which let the students be the co-creators of knowledge.

3. Multimedia educational games

Creating the best environment according to effective learning, regardless of the content of education, must meet a number of wide ranges of technical, pedagogical, and social requirements. The students, as the software end-users, expect the educational system to include standards of human-computer communication, which they have become accustomed to while playing games. On the over hand, teachers expect the education system to meet the standards related to the knowledge management rules. New technology make the education be flexible and activate students as they can learn in most suitable conditions – they can choose time, place, knowledge sources and the way they absorb new information. Moreover, Coase and North observed that economical success depends not only on technological development but also on society capabilities to use the existing technology (Godłów-Legiedź, 2010). Competences connected with using IT are crucial due to education and existing on contemporary labor market. They are concerned as most important competences for 21st century human being, called key competences. (Dąbrowski, Kwiatkowska, 2012)

What meets the both groups' requirements and develop IT key competence is a structural model of multimedia educational games (Fig. 1).

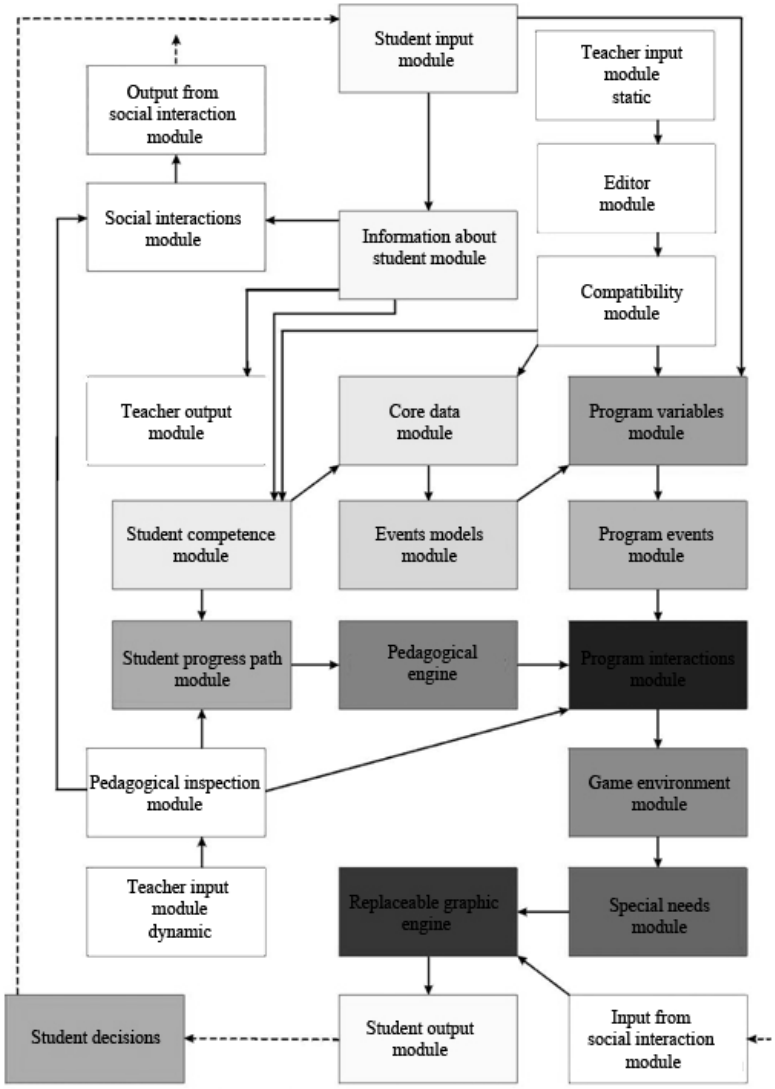

Fig. 1 A structural model of multimedia educational games (Kołacz, 2012).

In the model there are three main courses of information flow: the main stream implementing the teaching process, the social stream responsible for social interactions among students, and the stream of knowledge management which involve the teacher not only into checking the students' progress but also actively modifying the education process. It is individually selected and offer relevant additional terms the student can become not only a buyer but also a partner in the longer term. It creates relationships between the school and students relating to the process by which, on the basis of different factors, the value is created and both sides benefit. Creating training programmes with specific information and knowledge is assumed and correlated with the requirements and needs of social reality, in which the student is taught.

For technical reasons creating decision-making game including mechanisms in the field of supply and demand has been divided into three stages. They correspond to the streams mentioned before. For now on, the main stream has been created.

As the program runtime environment the Android platform has been chosen it was necessary to adjust the student input module to the specific use due to portable devices. Data input by keyboard was replaced by clicking (touching) buttons as presented (Fig.2).

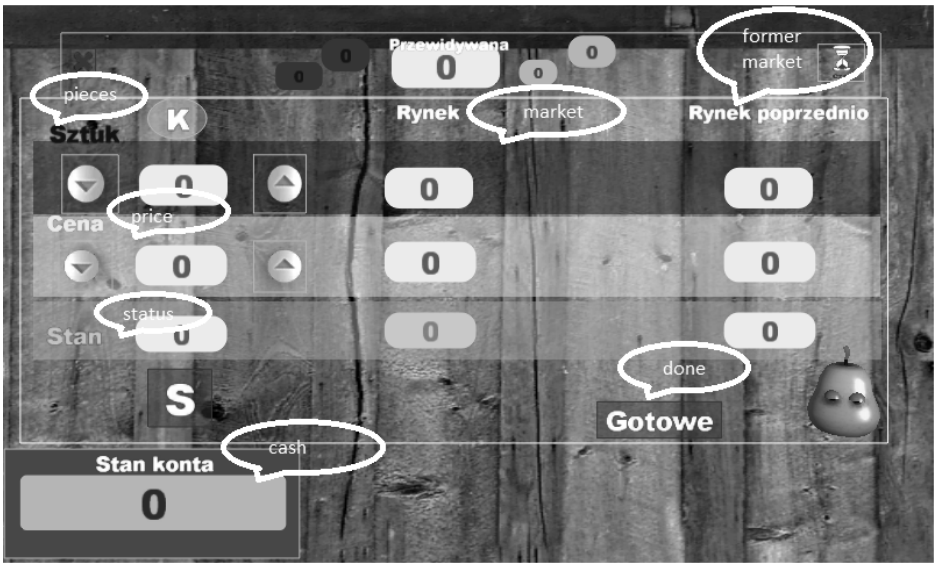

Fig. 2 A screenshot of action selection.

At this stage of implementation all the necessary information about each student (personal data, the level of education, institution she/he attends to) is not introduced to the program. It is stored in a traditional way - paper documentation. It needs completing the stream of knowledge management as schools should be active participants in creating new knowledge sector (Białecki, 2003). New technology can be usable tool for creating and transferring knowledge in education system. Then the teacher using the mobile aplication will be able to enter the data information into the system.

For the same reason "Information about the student module" has been limited to internal database in the program. It includes the following information: student's name, age, level of education, institution he/she attends to as well as name and address of the tutor teacher, time of using the program, the tasks carried out by the student (including the path and time used to solve them) and text recording of social interaction (exchanging information among students, helping other students in performing the tasks. It can be providing virtual financial resources in the program). The current version of the program collects information about the student's time of work inside the program and available ways of the tasks solutions. The data is prepared for storing and sharing

within the knowledge management stream. It is planned to be run on Windows and Mac platforms, too.

"Student competence module" contains the structure of all the competences that each student may acquire by working within the program. It can be practical familiarity with the mechanisms of supply and demand, acquainted with the concepts of profit and revenue, cost and losses, referring to the dynamics of the market. To all the competences there were added parameterized indicators determining the degree of student's assimilation (mastering). Each competence has also a list of common mistakes committed by students during the study. The lists are dynamic. They are replenished in the course of the program by the Pedagogical engine, too.

The qualification of student competence allowed implementing basic resources of the program in the "Core data module". These can be "visual" and "software" resources. What is visible by the end user are not only three-dimensional models of the goods on the market, graphical representations of the user menu (e.g. buttons, labels, etc.) but also the sounds played while working with the program. The data that the student has only indirect access include the initial prices of products, prices modifiers - a list of factors affecting the change in prices.

Raw data must be described in the "Events module models" in order to make them change. The module describes the mathematical models responsible for the calculation of price changes in the market. There are also models of random events. All models are stored in the form of a function (program blocks) enabling their direct commissioning in the program. Both - the student and the teacher do not have direct insight into the used models and can know them better only through the effects analysis of their actions.

To allow the dynamic changes to be available in the environment of the program (including changes in the virtual market) it is necessary to introduce variables into the program. There are declared program variables that are used to store temporary values for all parameters in "variables module". They may be current commodity prices, instantaneous modifiers change, intermediate values of mathematical formulas used in the models of phenomena. The separate category is environment variables associated with operating of the program. They store not only current activities undertaken by the student (e.g. touching the screen) but also the size of the program window, representations of resources - three-dimensional models, windows, menus, etc.

What is inextricably linked with program variables are program events. "Program events module" describes each event that can occur while working in the program. Such events can be data input by the student (touch), the value of the parameter change in the market, the end of the game turn, cancelling the action. Events that are not described in this module will not be supported by the program. It means that if no action has been described for changing the screen orientation the program will display only horizontally regardless of any attempts to rotate the device made by the user. Data

from the program events module are processed in the program interactions module. However, this module requires also the data including teaching process.

The list of competences contained in the “student competence module” is transferred to the “student progress path module”. In this block of the program there are established competence targets (final ones) which should be reached by the student by working with the program. There are initial powers founded which are also associated with both - economic knowledge as well as technical skills necessary to use the program. For one target competence there can be more than one path to lead. The path in context of the program is a set of consecutive requirements to be met by the student to master a specific skill. The shortest path consists of the initial and target competences. There are usually some indirect powers (milestones) within the path. Some educational paths can branch out and create a network of competences. The competence network there is also "blind " path considered which is incorrect attempt to solve the task by the student.

Reaching any competence (including initial is regarded as a marker for starting the nature trail) as well as the entrance to invalid path is recorded by the “Pedagogical engine”. This module must also decide about locking or sharing educational paths for students. It adjusts the level of task difficulty due to the student's current skills.

“Program interactions module” collects information from “program events module” and “the pedagogical engine”. It is responsible for any combination of student activities and decisions from the pedagogical engine. Here it is also possible the action to be taken by the teacher due to “Pedagogical inspection module” (not implemented functionality). All ready information is transmitted to the game’s environment.

The game environment module is responsible for creating the game world. It prepares information from all previous modules to be displayed on the screen, to play through speakers or to send over the network. Here are the features that decide how the particular information will be presented. It can be the sound from a pool of available notes to be played at the end of the nature trail. This module allows also adjusting the handling and display of the program due to the user's preferences as setting the sound level, the quality of graphics, etc.

Before the final information will appear on the screen, it is still necessary to adapt their content to the needs of people with disabilities. It deals with the special needs unit. Depending on the settings, it can change the colours display into the colours of high saturation and / or contrasting colours. It can also run the zooming of the image (in whole or part) and replace / supplement the graphical information of their counterparts sound. It can also substitute sound events into graphical icons. Since this module is going to be configurable by the teacher panel, its functionality is not yet fully implemented in the program.

Displaying all the information on the screen of the output device is possible by replaceable graphic engine. It is responsible for overriding the covered elements, queuing Window menu, adjust the size of graphic objects to the size of the display. It is ex-

tremely important that the graphics engine was removable, i.e. that could be easily updated and adding new graphics resources is easy. Because the graphical layer of the program is the most exposed to the "aging technology" it is necessary to periodically refresh. Educational programs opposing to games entertainment should maintain a constant function and mechanisms of the game, but their appearance should be adjusted to the hardware capabilities – it should be matched to technical progress.

The last element of the program is "student output module". The hardware layer is responsible for the technical implementation of the information flow to the student. In addition it carries audio as well as specific interfaces such as feedback combined with the vibrations of the machine.

The described construction of teaching the decision-making game, modelling economic processes is now in the development phase. It is necessary to supplement the missing streams: knowledge management and social ones. Only the complete design of the program let assess the actual effectiveness of the teaching of the presented solution.

The chapter considers the issue of the utility research in pure science and pure knowledge as crucial element of economic development at contemporary market. It concerns also society attitude to creativity and development as much as science development due to individual's creativity and talent assisted by value system in particular society culture (Godłów-Legiedź, 2010).

4. Conclusions

Summing up, the authors presented what can be the factors of economic knowledge growth. They are ICT, science and education capital (Kawa, 2004). Moreover, Smith also concerned that education and learning are forms of investment in people and Marshall said that the most valuable capital is the one invested in human beings (Bagieńska, 2010). That is the reason why the mobile application is presented by the authors not only as didactic tool but also investment into next generation's economic knowledge development in secondary schools economics curriculum.

Due to rising power of knowledge in economic growth there are new requirements concerning economic education that should be based on knowledge-based economy factors. However, the power of economic education system is not relating only to individual teachers' competences but the effectiveness of the whole range of didactic tools available to students (Fazlagić, 2011). That is why improving knowledge management in Polish education system is so relevant.

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Summary

The aim of the chapter is to present new technology capabilities to increase effectiveness and efficiency of education basing on knowledge-based economy (KBE) as those which are directly based on the production, distribution and use of knowledge and information. What is especially crucial for the authors is to proof that connecting usage of the knowledge and IT tools let develop Polish economic education in secondary schools. Due to OECD experts what is crucial is permanent education as in KBE only permanent development of knowledge allows reaching success. Moreover, contemporary set of didactic tools used in economics curriculum should prepare students for professional life in which learning by doing and interacting with others are becoming increasingly important factors. The solution for the authors used in contemporary economic education secondary schools program can be mobile technology in learning process.

CHAPTER 5

Interactive prototypes in teaching user-centred design and business process modelling

Marcin SIKORSKI*

1. Introduction

In managing information technology (IT) projects appropriate organizing cooperation with prospective users of the system is one of key success factors, no matter whether the object of design is software, equipment or service. For a student – as a prospective project manager – acquiring relevant practical skills only during the classes is difficult, because courses are often overloaded with theory, so actual work on design tasks takes only a fraction of teaching hours. Moreover, interaction with the instructor during design project is restricted to instructor-student relation, with instructor's role limited mostly to correcting student's errors, hence developing relationship similar to the one between a real customer and a real developer is rather unlikely to occur in university settings.

At the technical university at any engineering course there are usually several courses related to (a) development of new product and (b) project management. Product development -related courses mainly develop skills relevant to understanding market rules and principles of consumer behaviour. Project management –related coursed include managerial topics, human resources management, decision making,

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risk management and other issues aimed to balance the "magic triangle" of typical project management constraints: cost, time and quality (Lewis, 2005).

For efficient managing it projects in the future, a student should also acquire the skill or effective communicating with project stakeholders, primarily with the customers (or prospective users). In the class it is very difficult to create work settings similar to actual project environment, especially due to lack of actual customer. For this purpose some role-playing exercises may prove useful, especially those ones in which students have to use visual communication techniques to communicate their design concepts to a simulated customer. Interactive prototypes and other visual communication techniques can not only improve communication within the students' team, but may also serve for collaborative evaluation of early design concepts.

2. Related research

Prototyping is a testing and evaluation technique being a crucial component of **User-Centred Design (UCD)** methodology, widely used in IT projects since the 1990s (Sharp 2005). Involving users in evaluation prototypes is also an important part of all iterative approaches for IT projects management, and Agile methodologies (Schwaber 2004) in particular. Originating from User-Centred Design, prototyping has also become a popular method for user-based validating design concepts in service design and development (Stickdorn and Schneider 2010).

In actual IT projects prototyping offers following benefits:

- identification and preliminary validation of user requirements already in early stages of the project;
- improves customer/user' attitude by showing that "something is already running", what develops user's "sense of ownership" for approved solutions;
- when prototyping is frequent, the greater frequency of contact with the customer, usually the less usability flaws and corrections needed at the end of work.

Prototyping is generally considered as an excellent tool for facilitating communication between the designers and other stakeholders (Dix et al. 2004, Snyder 2003).

USER INTERFACE PROTOTYPING is one of visualization techniques often used in author's classes. Prototyping not only helps to visualize design concepts in an interactive way, but also teaches students how to present the concept to instructors and to classmates.

Among various visualization techniques useful for developing communication skills related to project management, following ones should be noted:

1. **Hand drawing design** techniques – useful for expressing design concepts, like:
   - formal diagrams and notations, like UML - Unified Modelling Language or BPMN - Business Process Modelling Notation (Schedbauer 2010), with their

formalized symbols, useful for depicting transformations and relationships which occur during system operation located in a specific business context;

- informal drawing techniques:
  - *Rich Picture*, a freehand drawing technique originating from SSM - Soft Systems Methodology (Checkland 1990), aimed on depicting a bird-view of the system and its multiple relationships with other actors in business environment; helpful in understanding the business context of the system operation and the roles of various stakeholders affected by the system;
  - *Mind Mapping*, a freehand drawing technique aimed to boost individual creativity by stimulating the right hemisphere of the brain, very popular and often used in both education and creative meetings (Buzan 2005).

2. PowerPoint presentations – commonly used (and overused), and even called infamous and trivial standard for office communication (Tufte 2006); on the other hand, with growing popularity of electronic documents and devices with screens in landscape mode, PowerPoint has gained growing popularity over textual documents for visualizing ideas or even preparing concise analytical reports, especially if they are going to be distributed via networks, displayed and discusses without hardcopy printing.

3. Prototyping – aimed at presenting how the design outcome will look like and to facilitate communication within the team and with external partners (customers, executives):

- low-fidelity (paper) prototypes, aimed to communicate general concept of the prospective system;
  - *storyboards* show in a hand-drown cartoon-like style the general sequence of screens when the user follows a network of specific operations (Snyder 2003);
  - *paper prototypes* may present the general layout of screen elements; they are usually "flat" two-dimensional prototypes laid on the surface of the table and can be used for optimizing their location and gathering first evaluations from prospective users or customers (Snyder 2003);
  - *service prototypes* are 3-dimesional prototypes made of paper and other stationery materials for visualizing how the designed service will work, who will be involved and what sort of User Experience will be created at subsequent stages of the service (Stickdorn and Schneider 2010);
  - interactive prototypes, prepared with a specific software prototyping tool, which lets simulate operating an actual system on a computer screen; such prototypes may be easily used for usability testing and for gathering requirements from prospective users (Warfel 2009).

All abovementioned techniques are useful for developing students' communication skills for prospective IT projects management. Nevertheless, practical competences have to be gained not by listening to lectures but by performing design tasks in a group.

This chapter describes experiences gathered during IT-related courses, where students - prospective software developers and project managers – build an interactive prototype of a touch-screen kiosk and learn how to recognize requirements of end us-

ers. The remaining part of this chapter will be focused on prototyping, extensively used by the author in several courses like "IT Project Management", "Human-Computer Interaction" and "Interactive Services Design".

3. Method description

The courses discussed here are a balance of theory and practice. In the final assignment in the HCI course each student has to design and present an interactive prototype of a specific system.

This teaching method has been designed with aim at achieving following **learning outcomes**:

- achieving higher involvement of students in work on their assignments,
- simulating a self-managed, small-scale project of a simple interactive system,
- developing a working, interactive prototype to be tested at the end of each semester,
- offering the students opportunity for developing communicating and collaborating skills; project work requires a lot of communicating, including also convincing, discussing, defending own ideas, developing constructive critique – all of them will be useful in students' future career, no matter if in engineering or in business management area.

Learning outcomes nay vary among specific courses, but all they have some common elements:

- course structure: 15 weeks, 15-30 lecture hours, 15-30 hours of labs/project in groups of 10-16 students;
- main learning objective: to teach students UCD approach in a role-played simulated project of an interactive system;
- lectures and assignments guide students through subsequent steps of a User-Centred Design project, based on the author's textbook in Polish (Sikorski 2010) or in English (Sikorski 2011).

The typical design task in the undergraduate level course is to design **a touch-screen kiosk** for tourist information or a similar relatively simple device.

The assignment handed in to students covers a brief 1-page description of typical tasks to be performed with the system and requirements for the interactive prototype to be demonstrated at the end of the course. The assignments are distributed in the 4-5th week of the course, so the students have remaining 9-10 weeks to complete a sequence of following **milestone tasks** for their project:

A. Performing context of use analysis
B. Preparing requirements specification document
C. Performing conceptual design
D. Building a paper prototype of the user interface

E. Building an interactive prototype and perfuming its usability test with potential users.

This assignment is a **role-playing project** because:

- students work in teams of 2-3, where one of the students is the project team leader;
- the instructor plays the role of a customer, who places the order for developing the interactive kiosk and demands its high usability and ease of use;
- during usability testing one of randomly selected students play the role of the user seeking information in the kiosk (developed by another group.

All prototypes are tested in the last week of the semester, and all the students take part in this group exercise, observing the tests and expressing comments and opinions about each of the presented prototypes. In the meantime, during the semester the students have to deliver the outcomes of their milestone tasks, and the outcome of each task is a starting point for the next task.

4. Design cycle and deliverables

As aforementioned, the assignment is a role-playing task: an instructor is a "customer" who places an order for an interactive system; a working prototype to be presented by a "developer" (student) at a given deadline, giving the customer the impression look-and-feel of a real system to be developed.

The **design cycle** in this course (Sikorski 2010) consists of following steps, with key deliverables marked *:

1. Accepting the assignment.
2. Information search, context of use.
3. Requirements specification document.
4. Visual metaphor of the system.*
5. Paper prototype.*
6. Interactive prototype.*
7. Usability test of the prototype.
8. Comments and improvements.

In the meantime, within the span of several weeks, a lot of communication will take place (within the team and between the team and the "customer"), with preference on discussing **deliverables** listed below:

- Visual metaphors and wireframes: design concept of the infokiosk has to be presented first as a graphical metaphor (several PowerPoint slides), giving the impression of a general look of subsequent screens. It gives also a cue about expected user interface consistency, interaction style and student's vision of the project.
- Storyboards: hand sketches of subsequent screens aimed to visualize "customer journey" through the prospective interactive system. It is actually seldom used

now, as students often tend to skip this stage, because storyboard is not a compulsory deliverable in this scheme.

- Paper prototypes: interactive paper prototype of the user interface has to be prepared and presented during the class hours. A small-scale usability test is performed, using tasks from the original assignment, and other students act as testers. The paper prototype is a first interactive visualization of prospective system, and resulting list of collected necessary improvements is usually long enough.
- Interactive on-screen prototypes: about two weeks after presentation of a paper prototype students are due to present an interactive on-screen prototype for final usability testing in a classroom. A 19-inch touch screen connected to laptop is used and as an input/output device, and three tasks randomly selected from the requirement specification document have to be successfully performed by a user - a randomly selected student from the group. Often enough, despite the prototype seemed to be sufficiently tested by now, surprising events in tasks execution frequently occur at this finals stage, sometimes making the "developer" very confused. Such an experience shown the need to make system yet more tolerant to human errors and to variability of human behaviour.

It is worth to mention that variety of delivered prototypes is very broad, because the students are given only a list of available prototyping tools, with no specific recommendations, which one is preferred or most effective. The choice of the tool is not affected by the instructor at all.

5. Outcomes and experiences

This assignment of developing interactive prototypes has been used in author's courses for about ten years, with about three courses running each year. Although the description of the system to be designed has changed several times in the meantime, this timespan allowed gathering some interesting experiences about the usefulness of this method, both advantages as well as some limitations.

Advantages:

- the assignment defines clear sequence of steps, milestones and deliverables, similarly like in a real project; it also invokes similar communication problems like in real settings;
- problem solving is easier when student is able to show visual evidence of the concept, idea or user interface element, so the use of styleguides, visual aids and standard widgets is promoted;
- prototyping offers ability to design and test dynamic behaviour of the system; even small-scale testing of paper prototypes give helpful design hints;
- preparing the on-screen interactive prototype for final usability test is also a motivating stage, because the students know the final acceptance will be based

on successful task completion (in fact, there are also additional evaluation criteria: functionality, ease of use and aesthetics).

Limitations:

- some students produce visual metaphors which are simply ugly but they think it is all OK as a "technical concept"; explaining them again what the role of metaphor actually is, and how its quality affects customer's attitude brings a delay;
- students have general problem of keeping the whole design consistent as to the look (screen layout) and feel (system behaviour);
- code bugs and other technical failures very often send the usability issues to the background; it happens usually if a student decides to work directly with the code, optimistically thinking s/he is a good programmer (but often is not);
- if a dedicated prototyping tool was used, produced code and graphics are not reusable, what makes the students much frustrated if they want to go further with their project;
- in exercise teamwork failed completely; formerly the students worked in pairs but it resulted that the design often enough was made almost entirely by one person; this is still an important and unsolved issue in this course, because the main objective of all group projects was enabling students to work in teams, as it goes in real projects;
- only few students are able to keep the original deadline; usually few days before mays students inform they will not be ready on time; although it is a frequent situation in many IT projects, the instructors keep the deadline hard (and then there is a small bonus for bringing deliverables on time).

As seen from the above list, there is a mix of positive and negative effects. Anyway, each time in end-of-the term course assessment this prototyping project is highly evaluated by the students as a very practical and useful design experience.

From the instructor's viewpoint prototyping is also very valuable: as in a real project, requirements change; also as a consumer one has to make important decisions and some negotiation of project scope and conditions will always take place. In interactive product design without visualization as the way to present the evidences what has been made, facilitating communication between the designer and the customer would be difficult and much more error-prone. Visual communication upon discussing subsequent versions of the prototype motivates the student to go on, and helps to keep track on the progress of design work.

In addition to the above, it worth to mention that presenting visual evidences of student's designs has also a positive impact on other classmates in the group (usually 10-15 students); they can see a variety of design concepts and discuss pros and cons of proposed solutions.

Fig. 1. shows examples of interactive prototypes made by the students in the author's course.

Fig 1. Interactive prototypes of a touchscreen information kiosk on cultural events. Sources: R. Swierczynski, I. Heimowska

6. Interactive business process prototyping

Interactive prototypes can be used not only for testing user interfaces or interactive services, but also for visualizing interactions taking place within specific business processes.

Business processes such as data flows, document workflows so far have been widely modelled with BPMN or other diagramming techniques. Teamwork in this area has been supported for instance by interactive whiteboards, helpful in concept mapping, however their functionality in mostly restricted to collaborative drawing of process diagrams.

Far more advanced solution is an interactive touch screen table, produced by a German company Metasonic, which supports S-BPM (Subject-Oriented Business Process Modeling) methodology (Fleischmann 2012). The interactive table, known as Metasonic Touch®, enables interactive prototyping of business processes and it supports teamwork in business process modelling and visualization (Fig. 2). For companies re-designing their business processes interactive prototyping stimulates team discussion, increases group dynamics, as well as it results in better understanding among team members by sharing acquired knowledge about the specific business process.

The Metasonic Touch table enables visual prototyping of the business process and it can be used to simulate the process supported by specific interactive system. As an educational tool, it can be also potentially especially useful for students of IT and management, aimed at spurring process-oriented thinking, while the interactive prototypes of the user interfaces stimulate user-centred thinking for project management.

As the website of metasonic.de says, "with Metasonic Touch, processes can be modelled graphically on a large table surface, from the perspective of the respective parties involved, easily using building blocks. Once the involved subjects – persons, computers or machinery – are defined, their behaviour is defined through these blocks. A keyboard is used to name the subjects and work steps. The modelling units have

codes on their undersides, which the integrated camera recognizes automatically. When two blocks are pushed together, a link is created between them and projected onto the table surface. Once everything has been modelled on the table, the individual work steps of the respective subjects are imported into the Metasonic Suite and compiled to form a process".

The potential of this touch screen-based method was a subject of a testing experiment performed during a seminar of the project Intranettime, aimed (among other research objectives) at exploring IT-based techniques supporting knowledge management and teamwork for developing intellectual of service organizations. The Metasonic Touch table was used as an experimental workbench for demonstration and testing new abilities for teamwork-based business process modelling and analysis (Fig. 2.). The session was attended by about 15 participants from business organizations and 5 PhD students from the university, plus seminar tutors and organizers.

Fig. 2. The Metasonic Touch TABLE used for interactive business process prototyping Sources: metasonic.de, J. Pniewska

The plan of the **experimental session** with Intranettime project participants was as following:

1. Introduction:
   - tutorial on the S-BPM methodology, within which Metasonic Touch table is operating;
   - participants were given a description of simple decision process taking part in a specific service institution.

2. Individual work:
   - participants were requested to (individually) map the decision process as a flowchart, identify actors involved and the logics of the decision process;
   - to identify values transferred among actors of the decision process, forms of this transfer and values (outcomes) received by process participants.
3. Teamwork:
   - basing on an individual understanding of the process, with the Metasonic Touch table the group started building an interactive prototype of the process using Metasonic Touch table;

- the Metasonic Touch table was operated by a Metasonic representative while the teamwork was moderated by the tutorial instructor;
- instruction how to connect the elements of the process came from the participants, who asked questions, discussed inconsistencies in their descriptions, and shared individual understanding about the process, coming to common consensual understanding how the process actually is performed.

4. Recap and discussion.

After performing experiment of interactive prototyping of a business process, following preliminary assessments could be gathered. In the opinion of seminar participants, interactive business process prototyping with Metasonic Touch table showed following **advantages**:

- increased group dynamics comparing to traditional methods of work based on use of flipchart or whiteboard, and provided more enjoyment;
- good visual overlook of the process, supported by zooming factions and adequate use of colours, allowed for explaining individual gaps in understanding the process;
- launched collaborative discussions on the diverse factors affecting the process and its outcomes.

There were some **limitations** observed, too:

- size of the touch screen about 1x1m makes the device suitable rather for small-scale flowcharts or it becomes necessary to divide a big one into subprocesses;
- there are limited opportunities for simulating the process and experimenting with suggested changes;
- effective teamwork for interactive prototyping needs a skilled moderator, who would be:
  - encouraging humbler participants to express/present their ideas,
  - negotiating individual views of the process,
  - able to combine at the same time: operating the device, maintaining the logics of the process and running conversations at the same time may be a challenge;
- the device itself attracts much of participants' attention, diverting them from the problem focus;
- smooth interaction is necessary to provide high usability of the device, in particular no time delays, easy zoom control, easy switching views of the process;
- process map validation and detection of potential errors nevertheless may be easier using a process map printed/plotted on a bigger sheet of paper.

As a result, participants of the interactive business process prototyping sessions found the experiment quite interesting, delivering positive experience especially in areas such as:

- collaborative learning, knowledge transfer among participants, converting tacit knowledge into explicit knowledge, sharing knowledge and deeper understanding the process;

- invigorating group processes and local resources, creating fun during teamwork, as well as it was an inspiring exercise both mentally and physically (to some degree).

Interactive prototyping with Metasonic Touch seems to be potentially useful for collaborative business process modelling in consulting and analytical projects. Moreover its potential may be appreciated rather by business practitioners who can see and understand a specific business process in its context; it seems premature for students who usually have no industrial/business experience and they will be predominantly attracted by high interactivity of the device and its pleasing User Experience. Interactive business models prototyping with the Metasonic Touch table offers promising opportunities, but needs a large-scale validation experiments be performed in order to assess its efficiency compared to other methods. Metasonic Touch is a commercial product, with option for an academic license, but within timespan of the Intranettime project it was not possible to assess its suitability of the Metasonic Touch table for university teaching.

7. Conclusions

Two types of interactive prototyping have been discussed in this chapter:

1. **Interactive prototyping of user interfaces**: performed in small groups, aimed at visualization of design concept and using an interactive prototype to perform usability testing of a specific system. It is useful both for students' design skill development and for facilitating communication during the simulated project. Interactive prototypes in student projects support problem-focused communication and discussion. Finally, interactive prototypes create important visual link to the emerging design artefact, making realization of students' projects more enjoyable, more effective and thus more remembered.
2. **Interactive business process prototyping**: a small-scale experiment with Metasonic Touch table gathered observations and opinions from participants of teamwork, revealing advantages and disadvantages of this interactive modelling methodology. Interactive prototyping with Metasonic Touch was found more suitable for supporting analytical and modelling work of professional business analytics and potentially less useful as an educational tool for university students who usually lack sufficient knowledge of business and local organizational context.

Nevertheless, both types of interactive prototyping may be complementary for all types of projects aimed at developing high-quality interactive systems and business processes supported by these systems in specific organizations.

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Summary

This chapter describes experiences gathered during the use of interactive prototyping in two areas: design of user interfaces for a touch screen information kiosk and interactive prototyping of business processes. Prototyping is promoted here as a technique useful for both visualizing design concepts and for stimulating communication within relevant teams.

Developing interactive prototypes of use interfaces is discussed here as a technique with several major benefits: it useful for visualizing design concepts, for usability testing and also for identifying necessary improvements of a specific system. It offers students' an excellent opportunity to observe their own design "in action", what gives instant feedback on user-perceived quality of the system, but first of all it stimulates customer-centred thinking being an essential skill of a prospective IT project manager.

Interactive prototyping of business processes was evaluated in a small-scale experiment with the use of a Metasonic Touch table, which allows for the teamwork in analysis and modelling. Outcomes of this experiment were twofold: advantages point out collaborative learning, knowledge transfer among participants, converting tacit knowledge into explicit knowledge, sharing knowledge and deeper understanding the process. In turn, disadvantages show that the touch screen device itself draws too much attention from novice users, thus being suitable rather for experienced business analysts than as educational tool for university students.

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CHAPTER 6

Nomadic Learning: Is It Delivering on Its Promise? The Tale of Two Projects

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1. Introduction

Wireless technology provides its users the ability to access various on-line content or e-services from any location, any time, and from any device. In many educational institutions the mobility advantage has materialised the vision for “nomadic computing”, which started experimenting with creating a "nomadic learning environment” allowing students to learn at any out-of-the-class locations (Olsen, 2000).

This chapter will discuss the outcomes of two projects related to introducing mobile learning environments in the Polish-Japanese Institute of Information Technology PJWSTK in Warsaw, Poland.

Both projects were based on the concept of "nomadic learning", where a student is a "digital nomad", equipped with mobile device able to play educational content to be "consumed" in any place also out-of-the-class, from any place where internet access works, in many short episodes across the day. Each of two projects was aimed not only to expand the university infrastructure towards introducing nomadic as a new teaching mode, but also to invoke changes in teaching methodology and culture for both learners and teachers. Experiences from these two projects will be briefly discussed and supplemented with conclusions possibly interesting also for other academic institutions.

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This chapter is also raising questions about implementing the nomadic learning concept in practice, as well as it argues that more research is needed on mechanism of adoption of m-learning systems in local settings of a specific educational institution.

2. Related research

2.1 E-learning and m-learning

E-learning systems have been used in academic institutions for decades. Typical functionality of e-learning systems includes (Carliner and Shank, 2008):

- storage and transfer of teaching content (texts, slides, video),
- tasks and assignments for students,
- marking and assessment of student's progress,
- procedures for course administration and reporting.

Contemporary e-learning systems are expected to support teacher-learner communication using tow web-based communication modes:

- synchronous: chat room, messenger, web conferencing,
- asynchronous: bulletin board, e-mails, mailing lists and forum.

Up to recently used on desktop computers, e-learning systems have contributed a lot to creating an electronic learning environment, which now is an important part of contemporary university education.

Across the timespan of e-learning systems gaining popularity in academic setting, the characteristics of user-learner (but also user-teacher) have also changed a lot. Nowadays members of academic community (both students and teachers) undergo following trends:

- often live under pressure of numerous deadlines;
- are mobile, often commuting among many destinations where their activity takes place;
- often communicate with others on-line (e-mail, Facebook, voice) and are often "on-line" all the time, staying within the range of from local wifi or using internet access form their cell phone operator,
- the border between their work and private activities has blurred, because people often study and work at home, what is endangering personal work-life balance.

As a result, small-screen handheld devices have become an essential part of personal equipment, being able to serve also multimedia content for entertainment or leisure. Moreover, multimedia content is an attractive time-killer in specific settings, like waiting in traffic jams, travelling in a subway or on a train, so for young people the habit of reading texts is often perceived as laborious and tends to become marginal.

These recent changes make educator's work nowadays more challenging, because a contemporary student:

- usually has grown-up in image-based culture, overwhelmingly supported by TV, films, videoclips etc.;

- has problem in focusing his/her attention on a specific topic needing longer mental concentration, hence he/she expects frequent switches among the topics during the lecture as it happens in TV channels, otherwise gets bored easily;
- last but not least, with the growing trend to reduce class hours at many universities, learning duties often have to be performed out-of-class as homework, library studies or field projects; in student's life now the learning takes place not always at home but often on a journey, in a mensa, on a corridor, in a campus park - wherever access to internet allows for accessing on-line content or downloading and playing it later in a more convenient situation.

On the other hand, many students nowadays have ability to learn from the screen only, not using printed hardcopies or paper textbooks as it used to be up to recently. Many textbooks are now available as e-books, what supports the educational trend for creating a portable, paperless and private learning environment.

Mobile learning (m-learning, often called for short) is the extension of e-learning, aimed at providing access to educational content on personal pocket devices such as netbooks, smartphones or tablets connected to wireless internet. The learner has ability to participate in a course "live" of "played", using small screen and headphones, provided that quality of image and sound in acceptable, and – more importantly – the learner is increasingly motivated to participate in the course "on the move", out of the class.

M-learning can also be viewed as a natural evolution of e-learning, by adding previously missing component such as the wireless access to the courses. E-learning can be real-time or self-paced, also known as "synchronous" or "asynchronous" learning. Additionally, e-learning is considered to be rather modular and presented in more structured manner than m-learning. In contrary, mobile learning is often self-paced, almost non-modular and informal in its presentation.

As most universities already have their e-learning systems, in many cases introducing m-learning is erroneously viewed as a simple extension of e-learning. Oppositely, m-learning is much more able to change the way how students learn and interact with their teachers, only if appropriate organizational changes have been made beforehand, and that reformatting of existing courses to the mobile format has been also performed. Obviously, there is always a considerable risk of non-adoption of m-learning (as a method and as a system), because there are many factors that may affect its efficiency and outcomes in real settings.

2.2 M-learning: benefits and challenges

Mobile technologies trigger expectations for receiving following benefits from mobile learning (Mobi21, 2014a):

- encourage "anywhere, anytime" learning mode out-of-the-classroom;

- reach underprivileged children affected by digital inequity;
- create new social interactions, improve collaboration and communication on-line;
- enable a personalized learning experience, based on own pace of learning or selecting an individual learning path.

There are also some challenges too, like:

- the potential for unethical behaviour of some learners or data privacy issues;
- mobile devices can be seen as distractions not suitable to be used in school;
- theoretical gap: there is no theory of mobile learning;
- evaluation of mobile learning efficiency in many cases may show superiority of conventional learning methods.

Implementing a m-learning in an educational institution is a complex project, so both benefits and challenges must be carefully weighted before an organization undertakes an effort to introduce mobile learning to their educational practice.

2.3 M-learning adoption dilemmas

There is ongoing discussion in the literature which model is the best to implement m-learning teaching methodologies, and which strategies are the most appropriate (Gea *et al.*, 2011; Mobi21, 2014b). Mobile learning implies that course content and other learning resources would have to be structured in such a way that learners may return to the learning content at any convenient instance. Moreover, reduced size of the device should not restrict accessibility to the course, hence the content should be formatted in a way focused on achieving high usability, accessibility and positive user experience. There is no unified view which sequence of steps is most appropriate for stimulating adoption of mobile learning in educational institutions; however if successful, mobile learning may dramatically change interactions among learners, teachers and course content, bringing substantial cultural change within a specific educational organization (Bryan, 2004).

It may always happen that despite an m-learning system has been implemented, it is not accepted as a part of educational environment, hence not used as intended. The general mechanism of adopting new information technology (IT) solutions has been explored by a Technology Acceptance Model TAM (Davis et al. 1989). The TAM model identifies following acceptance contributing factors, shaping users' attitude when they encounter a new IT-based solution:

- external variables: environmental factors, context of use factors;
- perceived usefulness: the degree to which a person is convinced that the use of a specific system will improve obtained results;
- perceived ease of use: the degree to which person believes that using a particular system or solution will be easy and free from additional effort.

In contemporary networked settings also other factors – organizational, administrative, economical or cultural may strongly affect acceptance of new IT solutions or services. If m-learning could be considered as sort of on-line service available within

specific educational process, then familiarity of target users with other on-line services they may use in private life can be an asset. On the other hand, it may also raise users' expectations level as to quality of m-learning content and services, because users will tend to compare them with quality and usability of (probably much better) commercial solutions they use in other contexts.

Adobe (2010) has published a report on usage of mobile services and how they affect consumers' lifestyle and habits. However, educational services on-line were not identified in this study as a significant part of e-customers' interest, comparing to on-line entertainment, financial services, information search and social interactions on-line. Nevertheless, familiarity with other on-line services and frequent use of handheld devices with no doubt are advantageous factors when planning to introduce educational services to a mobile context of use.

Factors encouraging user's choice of a specific handheld device in a mobile context were in the focus of a recent study performed by Redlarski and Sikorski (2012). They identified four major situations (contexts of use) in which users declared to benefit from using on-line services:

- "home": indoors, when performing spontaneous, usually not work-related tasks,
- "journey": during the journey, in the means of transport, urban commuting, etc.
- "desk": sitting at the table, usually while performing a specific mental work,
- "field": all other situations outdoors - in the city, in a pedestrian traffic, on a trip, etc.

Most popular on-line services accessed by subjects in mobile context during this study were: e-mail, address book, travel services, commuting and travel info, maps, news, weather, finances, transfers, cell phone pop-ups, e-shops and entertainment on-line.

Participants in this observational study reported the following problems, discouraging them from using on-line services with mobile devices:

- unreliable data synchronization between different devices,
- difficulties in opening and saving attachments (PDF, MS Office),
- the need to print a document from a mobile device and other printing-related difficulties,
- the need to wait until the mobile device reboots after hanging up,
- poor usability of mobile applications or m-websites,
- slow data transfer on wifi or cell phone networks.

As a result, main factors determining users' willingness to use the device for accessing on-line services in mobile context can be considered as:

- sufficiently attractive relationship of the time in which the device is ready to use to the duration of the task to be performed,
- low tax complexity (low cognitive load),
- low demand as to precision of manual operations,
- expected format of task result as screen-only (no printing is needed).

Table 1 presents a summary of tasks characteristics guiding users to allocate to specific handheld device to the task, provided users had a choice all devices were available on hand, and connected to local wifi.

Table 1. Preferred handheld devices depending on characteristics of user's tasks

Task characteristics	***Preferred handheld device***
• long-term task, requiring long-term mental concentration (sustained reading and/or precise manipulation) • the need for protracted typing • seating position is preferred, usually at the table ("desk") • the use of printer is necessary	**laptop/netbook**
• frequent, short tasks, periodically repeated but not requiring sustained mental attention • the need for only a short typing on the touch keyboard • when it is not necessary to use the printer (or other peripheral devices, not including headphones) • tasks frequently performed "in motion", in standing posture or while performing other tasks at the same time	**smart phone**
• reading longer texts, without using the keyboard, and usually without the need to print the document • entertainment, multimedia • sitting posture is usually preferred, often in a relaxed mode	**tablet**

Source: based on Redlarski and Sikorski (2012)

The content of Tab. 1 indicates a pattern that describes the characteristics which determine the willingness of the user to access a specific on-line service with a specific handheld device, assuming availability of diverse handled devices and user's freedom to choose the most suitable one.

This research also suggests that in case of prospective use of handled devices for m-learning, learner's tasks should be appropriately structured, and primarily, the teaching method and content of the course must be tailored to mobile context of use. Especially the user's demand for comfort drives the m-learning value in comparison to value received from other alternative channels of access available in multiple contexts of use – a class, home, travel or any other environment. Therefore, due to specific time span of demand for user's cognitive attention, not all courses available in e-learning mode may be suitable for converting into m-learning. Poor usability of the m-learning platform or poor structuring the course content, both resulting from neglecting ergonomic factors relevant to mobile context of use, may result in poor usage of a m-learning system and in failing to deliver expected value to the user – a potential learner.

Following sections describe experiences gathered in two projects aimed at delivering m-learning services to the students; a first one "Nomadic 1"[1] was based on the concepts of "nomadic learning", while the second - "Nomadic 2"[2] attempted to combine the "nomadic" learning mode with puzzle-based learning approach.

3. Nomadic learning - two educational projects

3.1 Rationale and background

PJWSTK (Polish-Japanese Institute of Information Technology) is a high-profile private university, located in Warsaw (Poland), offering graduate programmes in areas such as computer science, social computing, digital media, design, architecture, management or Japanese language and culture.

For almost 15 recent years PJWSTK has developed a robust IT infrastructure supporting didactic processes, including also e-learning, broadcasting for media on the Internet as well as advanced multimedia authoring environment. These resources however were not integrated into one, consistent system, and were not managed in a systemic, coherent manner. Paradoxically enough, it did not affect the quality of teaching the university was known for. Despite of high position of PJWSTK on the Polish education market, so far the university has not developed an internal system for quality management of teaching processes; high quality of education results seem to be resulting rather from high competences and personal engagement of teaching staff than from specific quality-driven organizational efforts.

Multimedia materials aimed for teaching should conform visual accessibility standards developed by W3C (www.w3c.org), because in PJWSTK there are some students who are sight-impaired or handicapped (and some foreign students who are studying only in English language). Unfortunately, accessibility standards so far have not been met, mostly because the teachers were not given guidelines how to prepare slides and other visual materials for optimal accessibility and ergonomics.

Therefore the mail goal of both projects described below was to create internal quality assurance system addressed to teaching quality, accessibility and efficiency, and additionally using latest technological advances in IT for education. The second goal was to introduce the ”nomadic learning” approach to educational practice of PJWSTK, because the students seemed generally well-equipped with various handheld devices. This factor was one of key points in these projects, as long as students’ commitment to mobile devices and their usage can create new opportunities for advancing education opportunities.

[1] full project name was "Nomadic Learning – Improving Quality of Teaching", further we use the "Nomadic 1" name for short

[2] full project name was "Puzzles for the Nomad", further we use the "Nomadic 2" name for short

3.2 Project Nomadic 1 – description

3.2.1 The concept of nomadic learning

Recent progress in information technologies made possible accessing various resources via wireless networks. This progress has changed not only the way how people work and communicate, but also how they solve problems in teams and how they learn. Contemporary, computer-supported process of learning (studying), connected with distance learning, has been transferred in a big part to private time and space, out of the "school building". Because nowadays learning takes place in different forms and in different places it is often called "nomadic learning". According to Alexaner (2004) "nomadic learning", is based on the assumption that a learner in the networked world is a "nomad", who:

- nowadays often gains knowledge and skills "in motion", outside the formal framework set by the conventional educations institutions,
- participates in various projects, communicating with other learners nomads connected in the network.

Because PJWSTK students seemed to be ready for prospective participation in a "nomadic" educational process, the abovementioned definition was accepted as a basis for launching the first project aimed to introduce nomadic learning in PJWSTK. As the students were already prepared, the main challenge undertaken in the project was to prepare the IT infrastructure, the teachers and the organization of educational process for the change that was going to improve educational practices in PJWSTK.

3.2.2 Objectives and scope

The principal goal of the Nomadic 1 project was upgrading the quality, effectiveness and accessibility of the teaching process, basing on latest IT solutions and on introduction of the „nomadic learning" approach. Specific objectives of the project were defined as follows:

- establishing an internal unit responsible for teaching quality assurance and evaluation;
- performing a series of training courses for PJWSTK teachers, aimed at upgrading their teaching skills relevant to advanced use of e-learning in teamwork-based educational processes;
- integration of didactic resources already available by PJWSTK with new multimedia technologies and making them accessible on-line;
- preparing new teaching programs, taking advantage the use of mobile technologies, supplementary to current courses which have been run in a traditional manner.

In planning the objectives and scope of the project it was included that both students and teachers are "nomadic" to some extent:

- students' lifestyle has become mobile (nomadic), while learning process has moved a lot to a private time, out-of-class, including extensive portion of time spent on commuting;
- teachers' lifestyle has also become more mobile (nomadic), as he/she teaches in timeslots scattered across the day/week, in various places sometimes requiring frequent travels among campuses; as a result he/she now spends relatively less time in the office, but still wants to stay in a live contact with the students regardless of physical location at a given moment.

Subsequently, accessibility for the students was expanded from the sight-impaired accessibility to educational process as a whole, focusing on accessibility on-line of the teacher during contact hours also form out-of-office locations. If intended communication functions could be sufficiently supported within the m-learning platform, then the vision of nomadic learning could be also extended by ongoing learner-teacher communication taking place beyond physical distance.

3.2.3 Project stakeholders

The target users in PJWSTK to whom the project addresses its outcomes were specified as two groups:

- all students – primarily from computer science faculty, but also social informatics, information management, digital art and other faculties (including distant learners and weekend courses),
- all teachers and external instructors involved in teaching.

3.2.4 Project stages and workpackages

Following work packages have been defined for the Nomadic 1 project:

1. **Establishing an internal unit responsible for teaching quality assurance and evaluation:**

- cooperating with the steering committee of the project and university authorities during the project;
- performing evaluation and diagnosis of current state as to the quality of educational products and processes in PJWSTK, and identifying areas if needed improvements;
- preparing a set of teaching quality oriented organizational changes in educational and administrative processes in PJWSTK;
- identifying teachers' needs as to professional skills development.

2. **Organizational and IT-related changes:**

- organizational: planning organizational, process oriented and structural changes in PJWSTK, consulting them with PJWSTK authorities, as well as establishing support for the teachers in the areas of upgrading teaching methodology and introducing multimedia materials to courses available on-line;
- IT-related: integration of available teaching resources into new on-line courses and expanding exiting e-learning system with new functionalities, creating sin-

gle access point to all educational resources within PJWSTK (internal educational portal, coordinated by teaching quality assurance unit).

3. **Performing a series of training courses for teaching staff in PJWSTK:**
   - new teaching methodologies, including advanced e-learning functions;
   - authoring multimedia materials for on-line courses;
   - Web 2.0. collaboration technologies in teaching and communicating with students by social media;
   - educational psychology, assessment methods and interpersonal communication.
4. **Setting up a usability laboratory for educational technology evaluation:**
   - preparing guidelines, templates and patterns useful for teachers in preparing multimedia materials for on-line (and traditional) courses;
   - usability evaluation of multimedia content, courses and teaching programmes available on-line;
   - supporting the teachers with consulting and advice on developing high-quality teaching materials of any kind.
5. **Integration and implementation of prospective solutions:**
   - distributing to the teachers materials such as guidelines, templates and patterns for preparing multimedia materials for on-line (and traditional) courses;
   - authoring multimedia content for new courses, to be streamlined for students using handheld devices in nomadic learning mode;
   - upgrading existing IT infrastructure for expanding e-learning system with new functionality, towards creating an internal educational portal accessible with mobile handheld devices.
6. **Conducting courses based on new programs and new (nomadic) model of teaching:**
   - preparing sample courses and testing their effectiveness with expanded IT infrastructure;
   - converting other courses to a nomadic learning mode and running classes with new teaching programmes and new multimedia materials available on-line.

Ultimately, as an intended result of the project, not only teaching quality should be increased, but also attractiveness of the teaching process for the students and its availability - in technical and human dimensions. Nevertheless, the decision will be left to the teacher whether to convert a specific course to the nomadic learning mode. Obviously, not all the courses may be suitable for the m-learning mode, as for instance some courses may require intensive face-to-face contact with the teacher. Because part of the courses will be still run in a traditional way, twice a year a teaching quality evaluation will be performed – both from the viewpoint of the students and the teachers.

3.2.5 Identified risk factors

Following risk factors have been identified for the project:

- short duration time for the project (one year),
- problems with external suppliers of software and hardware,
- software development performed in a big part by internal forces,
- implementation problems relevant to organizational, human and technological issues,
- smaller than expected interest of students in using m-learning, eventually resulting in m-learning adoption smaller than planned.

3.2.6 Project duration

This project lasted one year, from July 2009 to July 2010 and was wholly financed by EEA Grants and Norway Grants via their Poland-based operating institution FSS.

Detailed presentation and discussion of outcomes of the Nomadic 1 project will be available in section 4.1.

3.3 Project Nomadic 2 – description

4.1 The concept of Puzzle-Based Learning

The second project, called Nomadic 2, was launched almost two years after the Nomadic 1 project was completed. Both projects were not only time-sequenced but also complementary, because:

- Nomadic 1 created an IT infrastructure and organizational solutions, as well as it allowed for training the teaching staff to use m-learning in their practice; it provided a fundament for using video and other dynamic content in e-learning systems, shifting towards nomadic mode as planned;
- Nomadic 2 was intended to deliver new value upon the results of Nomadic 1, but it was aimed at combining (already existing) nomadic learning with puzzle-based learning, which is a novel and promising educational methodology.

Puzzle Based Learning (PBL) is a new teaching and learning methodology that is focused on the development of problem-solving skills. As the PJWSTK-affiliated creators of PBL (Michalewicz and Michalewicz, 2008) argue, what is missing in most curricula – from elementary school all the way through to university education – is coursework focused on the development of problem-solving skills. Most students never learn how to think about solving problems. Throughout their education, they are constrained to apply the material from each chapter to solve a few problems given at the end of each chapter. With this type of approach to problem solving, it is not surprising that students are ill-prepared for addressing real-world problems. This traditional approach so far has dominated the educational arena – whether in history, physics, geography, or any other subject – almost ensuring that students never learn how to think about solving problems in general sense.

The main difference between PBL and a traditional way of teaching relates primarily to the methodology. Traditionally the classes are ready to learn the techniques of problem solving, given in the textbook: as they are put in front of us ready-to-use,

hence we do not take the effort to discover them. Then after a student graduates, goes to work and is confronted with a real new problem, he/she faces a question: how to solve it if the ready-to-use solution from the textbook does not work? Unless we have not learned the discovery techniques for problem solving, we are jammed in standardized hints, which hinder our abilities and performance in new situations. Puzzle based learning invokes independent thinking, transferable also to other areas of private or professional life (PuzzleBasedLearning, 2014).

The PBL leads to exploration of the problem space and to creative discovery of a suitable problem solving method. In PBL human error is a good thing, as it encourages to try harder and to induct conclusions on consequences of errors. If available on-line, PBL could be an attractive part of m-learning environment, offering nomadic students a challenge on-the-go, with advanced multimedia demanding bigger span of attention, not always possible in mobile settings.

For these reasons the PBL methodology was found in PJWSTK as an interesting add-on to already exiting m-learning infrastructure, potentially resulting in the development of new skills among target users – and not only among the PJWSTK students and staff.

4.2 Objectives and scope

The launch of this project was motivated by two basic factors:

- low popularity of long-life learning among young people in Poland, who tend to believe that university should still teach a profession good for years of someone's life;
- incompatibility of skills acquired during academic education to the needs of labour market, especially in the case of graduates from humanistic faculties.

The Nomadic 2 project (yet in progress) is aimed at developing solutions that allow young graduates from humanistic faculties (high schools and universities) to supplement new knowledge and skills, particularly sought after by employers. In addition, m-learning based solutions will offer a completely different quality and form of education, tailored to the expectations of young people as well as to the needs of the labour market. Because the learning content will be under continuous adaptation, the project will result in developing an innovative feedback-oriented learning model, combining puzzle-based learning (as a brain teaser) with nomadic learning mode. The training will take place in the form of multimedia courses in the areas of science, knowledge management, entrepreneurship, etc. Graduates of the humanities, after having selected specific courses, will be able to take the chance in competitions, quizzes, social games expanding their skills needed for contemporary professions such as a virtual teamwork leader, social marketer, information manager, health educator or media-based distant teacher.

Three basic deliverables have been defined in this project:

- PBL teaching methodology to be transferred to PJWSTK teachers;

- m-learning platform to be adapted for PBL-based courses and tasks;
- developing PBL-based content (tasks, games, quizzes, puzzles etc.), which will bring more interactivity into educational processes and will be more attractive for learners mainly from outside PJWSTK.

Ultimately, after completing the project, the PBL nomadic m-learning platform (owned by PJWSTK) will be available in open access to all parties, individuals and organizations, interested in reshaping their skills in response to latest demands in a labour market. As a result of this project, in the coming future many puzzle-based learning blocks will be available as game-like apps for smart phones, tablets or other handled devices.

4.3 Project stakeholders

Following project stakeholders have been identified for this project:

- young graduates of humanistic and social studies, who enrol PJWSTK for their further studies as well as any individuals interested in pursuing their skill development with PBL as a part of individual life-long learning education;
- teachers from PJWSTK, but also external instructors, interested in preparing new courses and converting existing teaching content into PBL-based courses; also institutions like vocational training centers or training companies will be able to share their own thematic courses, preferably PBL-based.

4.4 Project stages and workplaces

1. Problem domain – analysis and diagnosis:

- analyzing gaps in skills among science students and humanistic students;
- identification of courses aimed at minimizing skill gaps and their suitability to puzzle/nomadic learning;
- assessment of educational material and its adaptability to puzzle/nomadic learning;
- developing requirements for "puzzle editor" - a tool for converting conventional educational materials into puzzle/nomadic learning methodology;
- converting a sample course into puzzle/nomadic learning, usability testing and performance evaluation with mobile devices;
- pilot study – testing the course with sample of target users, user satisfaction survey;
- analysis of outcomes from pilot study.

2. Conceptual design, prototype solutions and implementation strategy:

- developing a conceptual design of a full-scale system;
- developing a guidelines handbook from converting courses into puzzle/nomadic learning;
- developing a puzzle editor – a tool for developing teaching methodology and converting the format of existing teaching modules;
- adopting e-learning platform for distribution of m-courses;

- developing an implementation strategy.

3. Testing of prototype solutions:

- testing course converting procedures in real settings;
- testing the prototype system in real settings for usability, accessibility and compatibility with standards;
- evaluating learning outcomes from target group and control group.

4. Evaluation of results from prototype solutions:

- evaluation of IT tools: e-learning system, puzzle editor and nomadic methodology editor;
- evaluation of matching course themes to the needs of target users;
- evaluation of efficiency for puzzle/nomadic teaching method and identifying necessary improvements.

5. Developing a full-scale system:

- a final set of courses;
- a puzzle editor and a version management system;
- a "nomadic" handbook with the puzzle-oriented "nomadic methodology" editor.

6. Promoting a full-scale system, its publicity and implementation:

- developing websites;
- promotion and visibility of the system for project stakeholders (social media, newsletter, leaflets, e-mailing, conference presentations);
- developing implementation guidelines for project stakeholders.

4.5 Identified risk factors

Having learnt from the Nomadic 1 project experiences, following risk factors have been identified:

- non-adaptability risk - content of some courses may be not suitable for converting to puzzle/nomadic learning methodology;
- non-systematic use of the system (by students or by teachers) may reduce learning efficiency;
- skeptical attitude of teaching staff to extramural, incidental and mobile forms of learning;
- lack or insufficient interest in new PBL-based method among teaching staff or among students.

4.6 Project duration

This project was assigned for two years, from 2013 to 2015 and has been financed by European Social Fund via their Poland-based operating institution.

Detailed presentation and discussion of outcomes of this project will be available in section 4.2.

4. Implementation and preliminary results

4.1 Nomadic 1 – selected outcomes

4.1.1 Implementation plan

Main components of the road map for the Nomadic 1 project are outlined in Fig.1, including the timeline of the project.

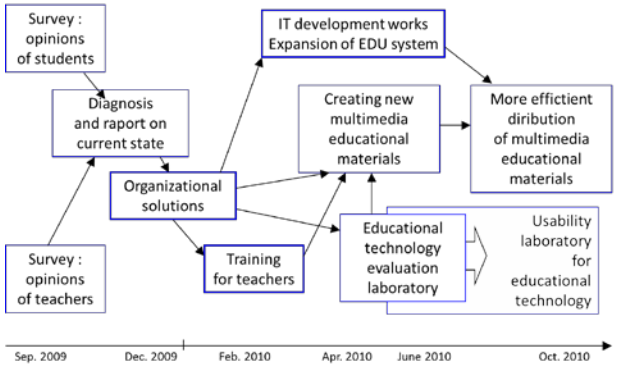

Fig. 1. The timeline and main activities in the Nomadic 1 project

Fig 1. presents only main activities related to nomadic e-learning, neglecting for instance software development works, IT infrastructure supplies and expansion of EDU - e-learning system used in PJWSTK.

4.1.2 Selected activities and their outcomes

Selected activities depicted in Fig. 1 resulted in interesting outcomes, shortly described below.

Diagnosis and report on current state

At this initial stage of the project two surveys were performed, which delivered following conclusions:

- the students in the survey criticized the scheduling the classes and inefficient informing on changes, and suggested more place for teamwork in university building; in turn, they appreciated quality of service offered by library and dean's office as well as the competence of teachers, quality of computer labs and composition of teaching programmes;
- the teachers in their survey were more critical, demanding improvements in following areas: administrative support for teaching, workflow of documents, regular updating documents and procedures, supporting in creation and publishing of electronic teaching materials, scheduling classes, and access to the "good practices" as to teaching quality.

These surveys were a starting point to initiating changes expected in areas related not only to nomadic learning.

Training for the teachers

As planned, a series of trainings for PJWSTK teachers was provided, including subjects such as:

- new educational methodologies, learners' activation techniques, project-oriented learning, evaluation of learning outcomes, interpersonal communication,
- developing educational content, advanced multimedia in teaching, methodology for m-learning, social collaboration on-line.

Expanding the EDU e-learning system

As planned, numerous software engineering works have been performed in order to adapt exiting e-learning system to handling and distributing multimedia materials intended for nomadic learning. These improvements included new functionalities for students and staff (like chat, forum, calendar, single logon, new user interface), but also many back-end works with databases and back-office systems used for administrative purposes.

Usability laboratory for educational technology

The usability laboratory was established with an intention of:

- developing methodology and patterns for improving quality and usability of educational materials,
- providing technical assistance for recording of high-quality teaching materials,
- providing guidance and advice to the authors of the materials.

Fig. 2 presents an example of a sample screen from a selected course using multimedia materials.

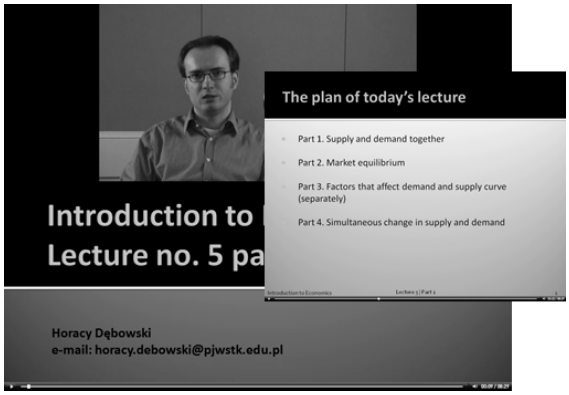

Fig. 2. A sample screen from multimedia course on economics

Organizational solutions

Last but not least, organizational solutions should be mentioned, but they will be not discussed in detail. They included activities not directly related to nomadic learning but equally important for the project:

- expanding internal quality management systems - organizational works, project planning and management;
- expanding IT infrastructure - IT project management.

4.1.3 Evaluation of outcomes

Majority of the project outcomes has been achieved as planned. However, as in many projects, some problems occurred in areas such as:

- coordination of work and timely execution of tasks;
- integration of emerging solutions;
- connecting new solutions with existing ones;
- implementation works made by PJWSTK full-time staff (additional workload);
- incomplete implementation of organizational solutions.

On the other hand, the Nomadic 1 project helped to outline new opportunities opening for PJWSTK as a contemporary educational institution. The project:

- completed the implementation of the new EDU e-learning system;
- facilitated access to materials for students by improved accessibility;
- facilitated easier creation of multimedia materials by the teachers;
- enabled further automation of administrative tasks;
- created support for teachers in the developing and distribution of educational multimedia materials;
- created possibility for high-quality recording of teaching materials self-made by teachers.

It should be noted that it was left to the teachers' decision whether to conduct their classes according to the new "nomadic" model. Nevertheless, the opportunity for studies in the "nomadic" style for everyone has been successfully created.

4.2 Nomadic 2 – selected outcomes

4.2.1 Implementation

For implementing PBL in practice two basic deliverables have been defined in the project:

1. The m-learning platform:

- a web portal aimed to distribute learning materials and courses;
- after the project, the system will be open for all interested parties, and all the content will be available in m-learning mode using smart phones, tablets or any other handheld devices.

2. PBL-based courses, prepared according to PBL methodology and guidelines

- 12 sample courses will be prepared during the project,
- user-friendly user interface and high system usability are considered as essential factors facilitating self-paced learning;
- the content of the courses and methodology of PBL teaching will be consulted by external experts from relevant domains.

Fig. 3 and Fig. 4 show sample screens of the administrative panel and of a sample course, respectively.

Fig. 3. A sample screen of the courses administrative panel

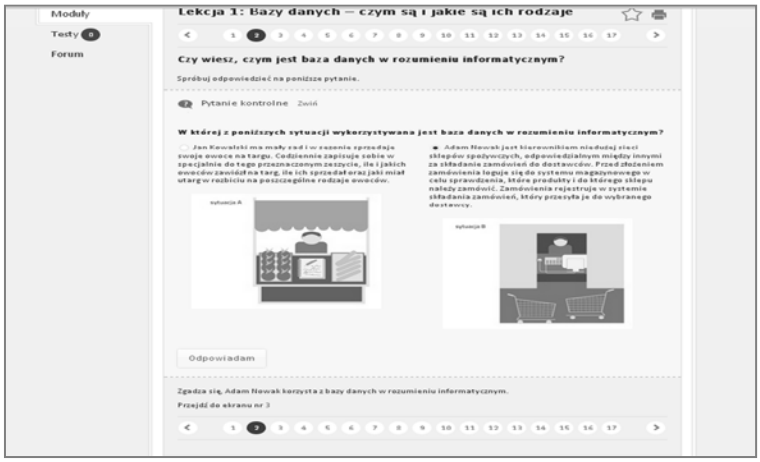

Fig. 4. A sample screen of a selected course

In both areas – developing the platform and developing the courses – iterative design and user-centred development methodology will be used, involving users and other projects stakeholders in order to assure high usability by extensive evaluation and testing of prototypes and conducting small-scale pilot studies.

4.2.2 Evaluation of outcomes

At the moment of writing, in addition to trainings and workshops for the staff, several modules of the m-platform have been already implemented. Fig. 5 shows the current welcome page of the PBL-based m-learning platform.

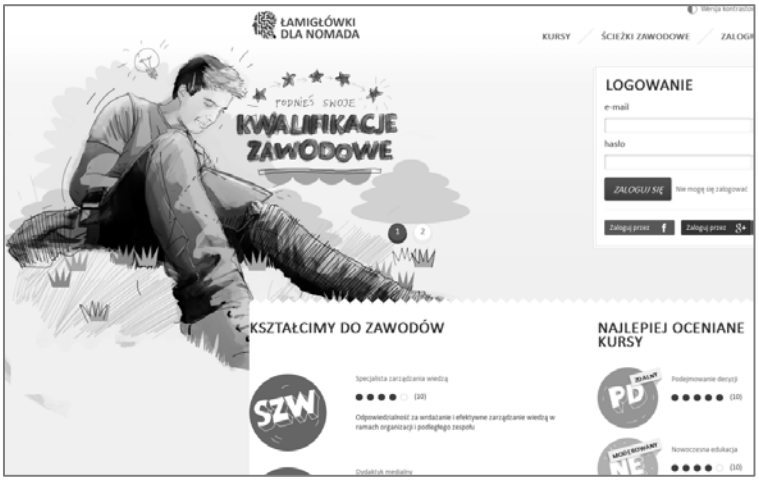

Fig. 5. The welcome page of PBL-based m-learning platform

Two types of evaluation approaches have been used in the project: internal and external evaluation.

Internal evaluation

Internal evaluation has been conducted by following evaluation groups:

- expert evaluations (Project Steering Committee supported by experts from PJWSTK), focusing on:
  - consistency of the whole education system learning;
  - adequacy of the system components to the needs of target groups;
  - degree of implementation of specific objectives, including the level of implementation of the system;
  - quality of project management and assessment of implementation outcomes;
- learner-based evaluations:
  - usability of the m-learning platform;
  - user experience from using the PBL modules;
  - willingness to use the m-platform and PBL courses in the future;
- teacher-based evaluations:
  - usability of the m-learning platform form the teacher's viewpoint;
  - evaluation of workload need to prepare the course with PBL editor;
  - teacher's user experience from using the PBL modules during the teaching and administering the course;
  - willingness to use the m-platform and prepare more PBL courses in the future.

In user-based evaluations questionnaire surveys were used, user workshops, user interviews and usability testing. Altogether about 140 learners participated in evaluation procedures (incl. 60 persons selected for measuring their skill increase), recruited mostly from the project's Facebook fanpage. Teacher-based evaluation was performed with a group of 15 teachers from PJWSTK. Evaluations were performed mostly as A/B testing, while one group used the new m-learning platform and the PBL-based courses, and the control group was developing their skills using traditional methods.

For expert evaluations mostly usability inspection methods and expert panels served as data gathering techniques. Altogether about 20 experts participated in different phases of evaluating the new teaching methodology and the m-learning platform itself.

As a part of internal evaluation also objective performance factors were collected, including for instance:

- quantitative metrics of system usage and learning outcomes;
- m-learning adoption data based on recorded behavior of users in a prototype system;
- time-related ratios related to learning curves and skill development among learners.

External evaluation

External evaluation by experts from outside of the project will cover:

- usability evaluation of a prototype m-platform and its individual modules
- teaching methodology evaluation assessed by an independent expert;
- evaluation of teaching modules selection in regard to matching the needs of the labour market;
- external audit of evaluation reports prepared from internal evaluations.

Because the project is yet in progress, this section presents only a sample of preliminary evaluation outcomes from the current state of Nomadic 2 project:

Preliminary evaluation of learning effects from a puzzle-based pilot course

A questionnaire survey addressed to learners delivered following results:

- average growth of knowledge: + 20% (as the difference between pre and post test);
- acceptance for structuring content: 87% of positive and very positive scores;
- evaluation of the use of interactive elements (in puzzles): 67% assessed positively
- courses completion rate: 80% of users who started.

Survey results among teachers

A questionnaire survey addressed to teachers also revealed their skepticism as to the PBL method:

- for some courses the use of puzzles may extremely difficult or impossible;
- puzzle based learning method is not a universal method, and hence does achieving specific learning outcomes may not be possible in some courses;

- puzzle-based learning implies a large number of interactions and feedback, including guidance from the teacher/group, which may be difficult to reproduce in distance learning conditions.

Guidelines for teachers and IT developers

Surveys and interviews with teachers revealed two groups of guidelines:

- the use of PBL and teaching methodology:

o using PBL should be not obligatory in the learning process;
o it should be determined far in advance which parts of existing course content may not be suitable for converting into PBL, and which ones can be more attractive for students as puzzles or quizzes;
o it is necessary to create a library of puzzles relevant to specific learning outcomes;
o developing easy-to-use puzzle editor is essential for the adoption of PBL;
o providing appropriate and immediate feedback for the user-learner;
o provide full accessibility of content from any device, any browser, by following the Responsive Design trend.

- the m-learning platform and its implementation:

o two overarching structures of the content should be created: one based on sequential diagram (the traditional process of teaching-learning), the other – scenario-based that takes into account programmed learning and will support individual selection of learning content;
o the m-learning platform should support asynchronous mode during the process of teaching and learning, which allows for flexible choice of learning time and diverse forms of work;
o the m-learning platform should support both individual effort for PBL as well as cooperation within the group; the m-learning platform should also support both moderated and non-moderated courses;
o the scope of content to be divided into short thematic pieces, ending with feedback data on learner's performance;
o the m-learning educational platform should allow for accessing the course content using mobile devices, with pay attention to user with low-end handheld equipment.

5. Further works and discussion

5.1. Nomadic 1

The Nomadic 1 project allowed for:

- developing organizational solutions supporting quality of teaching and skill development;
- expanding the IT infrastructure for nomadic learning mode, and m-learning in general;
- establishing usability laboratory and providing support of teachers;
- expanding existing e-learning system towards internal educational portal, suitable for streaming educational video multimedia material.

The Nomadic 1 project was completed on due time and its results were used a basis for starting the Nomadic 2 project.

5.2. Nomadic 2

The Nomadic 2 project allowed for:

- identifying the expectations of learners and teachers as to introducing PBL as a novel educational method;
- training teachers in PBL method and in converting traditional e-learning blocks into PBL based quizzes, puzzles and contests;
- developing ample courses, performing user-based evaluation and gathering feedback useful in developing full version of the m-learning system and full set of PBL-based course materials;

The project is yet in progress, so evaluation results are only partial at the moment of writing, however obtained results look promising.

Further works include integration of m-learning platform with newly developed PBL-based courses as well as further training of more teachers (also from outside PJWSTK) to encourage them to use the method even before the project is fully completed.

Both projects were equally aimed at strengthening educational potential of PJWSTK, but they differed in several distinctive aspects, shown in Tab. 2.

Table 2. Main differences between the Nomadic 1 and the Nomadic 2 projects

Evaluation aspect	***Nomadic 1***	***Nomadic 2***
project duration	- 2009-2011 (13 months)	- 2013-2015 (36 months)
project focus	- m-learning, nomadic learning	- Life Long Learning (LLL)
added value	- developing IT and organizational infrastructure for expanding e-learning to m-learning - developing multimedia content to be streamlined on-line for handheld devices - expanding administrative functions of existing e-learning system	- combining m-learning platform with the PBL methodology - developing PBL courses - developing new distribution channels upon existing e-learning system - promoting cultural change towards mobile learning and out-of-the class relationships with the teacher, group and institution
target groups	- PJWSTK students and staff	- users inside and outside PJWSTK
main deliverables of the project	- organizational solutions for teaching quality - IT infrastructure development - developing multimedia content and reformatting the courses for nomadic learning	- m-learning platform - PBL courses - tools for converting existing courses into PBL blocks
design and development methodology	- content-focused design	- user-centred design

milestones of the project	- analysis, incremental development, no pilot study	- analysis, pilot study, full-scale system
project management paradigm	- quality-driven process	- change management
teaching methodology	- multimedia courses for e-learning	- puzzle-based learning combined with nomadic learning (m-learning)
skill development	- training for teachers: teaching methodologies and e-learning	- training for teachers: puzzle-based learning, methodology for nomadic learning and converting courses to a new format

Both projects can be considered as two parts of the same meta-project – long-term revitalizing the teaching infrastructure expanding teaching methods and enhancing quality of teaching for all stakeholders of the educational process in PJWSTK.

6. Conclusions

Despite of successful progress of both projects, the problem remains unsolved how to secure wide adoption of a full-scale m-learning system without forcing administrative regulations. Sophisticated measures for success have been defined in the running Nomadic 2 project, but it may happen that even fascinating PBL-based courses may be found as interesting curiosity rather than a serious teaching method. Therefore the human factor - commitment of teachers, developing their skills and tracking the changes in lifestyles of end users – they all seem to be crucial factors for successful implementation of m-learning, extended with the PBL methodology and the nomadic learning approach.

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Summary

This chapter discusses the outcomes of two projects related to introducing mobile learning environments in the Polish-Japanese Institute of Information Technology PJWSTK in Warsaw, Poland. Both projects were based on the concept of "nomadic learning", where a student is a "digital nomad", equipped with mobile device able to play educational content to be "consumed" in any place also out-of-the-class, wherever internet access is, in many short episodes across the student's day. Both projects were aimed not only to expand the PJWSTK university infrastructure towards introducing nomadic learning as a new teaching mode, but also were aimed to invoke changes in teaching methodology for both learners and teachers. Experiences from these two projects have been briefly discussed and supplemented with conclusions and guidelines possibly interesting also for other academic institutions. This chapter is also raising questions about implementing nomadic learning concept in practice as well as about factors affecting its efficiency in real settings. This paper concludes that more research attention is needed on understanding the mechanism of adoption of m-learning systems in local settings of a specific educational institution.

CHAPTER 7

Teaching management skills to software development teams through the lean start-up methodology

Piotr OLEKSIAK*

1. Introduction

Software engineers come from a technical background and are focused on solving technical problems. This perspective may result in overdeveloping products without bringing extra value or even developing products that are not sought for by the intended customer segment. In order to reduce the risk of such situations members of development teams are required to possess managerial skills.

Managerial skills today are an important factor throughout the organization and not limiting to managerial positions. Software development teams are required to provide customer value at a level that exceeds their programming competencies thus a need to bring a more client orientated approach is becoming a necessity.

Both development houses creating products ordered by clients and start-ups offering their own products to customers face the problem of misunderstanding the objectives of the given project and concentrating on programming rather than solving the customer's problem. Programmers invest time and effort to launch the product without sufficient customer input. Only after launch does substantial customer feedback arrive.

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It is not uncommon that months or even years of development conclude in the customers not needing or wanting the product's features. (Blank, 2013)

This problem costs companies substantial funds and is limiting the potential of new tech start-ups. Although entrepreneurship is among the most important forces in a modern economy (Kedrosky, 2013) creating products nobody needs significantly lowers the capability of new companies to last in the market.

It has become clear that successful software product development apart from high quality coding skills must also utilize managerial skills throughout the team. Managerial skills and the incorporation of available methodologies will help developers realize if current development is necessary at a given moment or if other measures have to be taken before further programming takes place.

2. The lean approach

To tackle the problems software development teams face different methodologies have been introduced and implemented in production. One of the key methodologies used in high tech start-ups today is the introduced by Eric Ries lean start-up methodology. The lean principles however date back to Toyata's lean manufacturing from which the lean start-up gets its values. In the early 1970s the Japanese based car producer Toyota optimised its production processes by developing principles called lean manufacturing. In lean manufacturing the processes are made more efficient through reducing any sort of waste in the process. (Womack, 2003) Waste in this context could be either reduction of resources or the elimination of unnecessary activities or expenses. (Mueller & Thoring, 2012)

Lean principles today have been incorporated in other areas such as management or software development. (Mueller & Thoring, 2012) According to research conducted by Shikhar Ghosh 75% of all start-ups fail (Blank, 2013). This significant failure rate has led to seeking ways of making high tech companies and introducing new products less risky. The lean start-up approach to reaching this goal is through favouring experimentation, customer feedback and iterative design. This stays in contrast with earlier development techniques based on elaborate planning and designing up front (Blank, 2013). Earlier techniques did incorporate investment in marketing research, however at the phase of product design companies often restrained from implementing customers' insights into the product itself (Osterwalder & Pigneur, 2010).

The lean start-up methodology is designed to give companies support in providing clients with products they want faster and at a lesser expense. Putting the methodology into the development cycle of a product helps to eliminate uncertainty and to work more responsibly on the product itself. The achieved goal is understanding if the intended product is worth developing and if a sustainable business could be built thanks to its development. The minimum viable product is a core component of the lean start-up methodology. The MVP is defined by Ries as a version of a product, which allows a

team to collect the maximum amount of validated learning about customers with the least effort. (Ratclife & McNeill, 2011) This could be further explained as the smallest thing that could be built that delivers value and allows for feedback to be collected.

One of the key elements emphasized by the lean start-up methodology is business model generation, a method aimed to replace the creation of business plans at the beginning of a project. The method introduced by Alexander Osterwalder and Yves Pigneur is based on the fact that business innovations are created in order to generate value for companies, clients and the society. (Osterwalder & Pigneur, 2010) Their business model canvas describes the logic of how a company is aiming to achieve profit through nine building blocks, which cover four main areas of business: customers, offer, infrastructure, and financial viability, serving for further strategy implementation through processes, systems and structures. (Osterwalder & Pigneur, 2010)

Thanks to its unique approach to product launch and development the lean start-up methodology has taken root in the start-up world and is beginning to be implemented throughout many industries in large corporations and even public service. Product development techniques associated with the methodology work especially well in software development and have been introduced in many start-ups as well as software development studios leading a new type of software development where developers take part in the business process. This new approach requires development team members to learn the core principles of the lean start-up methodology.

3. Value proposition

For the stakeholders, who are funding software development it is important that the revenue from the software exceeds its cost. Success of a project is defined by delivering value to the organization. Senior management are interested in results, which is the return on investment in the project. They often do not have the time to engage in individual projects and expect the development team to take care of fine detail. (Shore & Warden, 2007)

In the past software engineers at times struggled to deliver products that brought the sought value to the customers. This was caused by not correctly understanding the needs of the customers, not emphasising enough on getting customer feedback and focusing mainly on building the product, which led to overdeveloping. Features that are not required by the customer should not be implemented as the cost of implementing features results in financial loss and product launch delay. Products should be validated to find if they solve a problem for the customer group. The goal is to discover this problem and test if it is worth solving. (Mueller & Thoring, 2012)

The value proposition is the reason why customers choose one company's product over the competitive one. It solves the problem needed to be solved by the customer and satisfies a customer need. Each value proposition consists of products and/or services that cater to the requirements of a chosen customer segment bringing benefits

sought for by the consumers. A value proposition may be innovative in a sense of representing a new offer previously not offered to the customers, it may also be a variation of existing offers. (Osterwalder & Pigneur, 2010) Both possibilities are of value only if they bring customers products that fit their needs.

When creating a new product software, developers tend to concentrate on past experience as this helps them develop programs and applications based on previous knowledge. However, when accomplishing complex tasks this attitude may prevent the team from creating the best value. In order to gather potentially innovative and groundbreaking thoughts there is a need to sustain from financial and technical restraints. Only after the ideas have been gathered should the experience of project members be employed to evaluate the concepts. Furthermore once creating a new business model it is not advised to concentrate on past experience, as this experience may not influence the choice of methods needed to be implemented in future value generating mechanism (Osterwalder & Pigneur, 2010) and value generation is the key to success in any software development project.

4. The role of testing hypothesis by software development teams

Many leading innovative companies, which market their products directly on consumers often take time to interact with the customers, sometimes on a daily basis. However to create innovative products it is not enough to ask customers what they need – you need to understand their needs. As Henry Ford, the founder of Ford Motor Company, is quoted as saying: "If I had asked people what they wanted, they would have said faster horses." (Osterwalder & Pigneur, 2010). This does not imply that the customers' opinion is the only perspective from which product development ought to be conducted, however the consumers' point of view should be taken into account in any business model (Osterwalder & Pigneur, 2010). The assumption that it is possible to discover the unknowns in business in advance, before executing the idea is misleading (Blank, 2013). That is why it is important for software engineers working on their own products or products for their clients to posses managerial knowledge and learn the needs of the clients before engaging in full development. If a company is creating a product nobody needs the fact that it is created in time and within the set budget is not relevant. Therefore it is important to track metrics using quantitative methods in order to analyse if the growth is measurable (Ries, 2011). The sooner it is apparent an idea is not working the sooner changes can be implemented resulting in money and time saving (Mueller & Thoring, 2012).

In contrast to traditional long-lasting development methods the lean start-up incorporates agile development, which builds products in short cycles creating a minimum viable product (MVP), gathering feedback and rerunning the cycles. Each cycle consists of planning, gathering requirements, analysis and design, implementation, testing

and evaluation. The cycle is represented in Figure 1. The goal of the build-measure-build cycle is learning. The product created is only based on previous hypothesis. Metrics are defined for testing the hypothesis on the built product and the test is conducted for learning purposes. The result can overthrow or confirm the hypothesis (Mueller & Thoring, 2012). If you consider one of your main hypotheses to be false a new strategic hypothesis has to be placed in its place. The lean start-up model enables creating companies using capital more economically, as it allows companies to realize faster that the time for pivot has come and this in turn translates to less waste of time and money. (Ries, 2011)

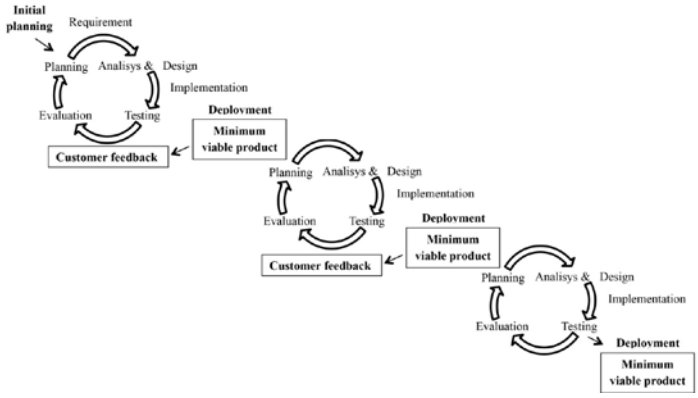

Figure 1. A build-measure-build cycle, (Blank, 2013)

Customer feedback is an important factor in software development and neglecting to emphasise its importance in software development projects leads to problems, which sometimes cannot be overcome. The need to go and find the answers to questions concerning the application of the product has been an underlying element of the lean philosophy. One of the key rules of Toyota's production system is taking strategic decisions based on customers' needs. In Toyota this rule has been called *genchi genbutsu*. The phrase can be translated to – go and find out for yourself (Ries, 2011). These methods have a representation in real-life situations as software engineers deploy their products they implement tests gathering feedback from customers on what functionalities they use and how they are used. Thanks to this if a product is used in a way earlier not anticipated changes could be made in the strategy and in later iterations of the product to fulfil the needs of the consumers. These changes are called pivots in the nomenclature of the lean start-up. The methodology does not specify a formula for when to pivot. There is no way to eliminate the human factor from entrepreneurship and more precisely eliminate such elements as vision, intuition or subjective opinions (Ries, 2011). Learning the skills of how to gather and address feedback by developers is helping companies save time and money, if a product is going in the wrong direction the team knows faster and has more resources to get the product on the right track. The lean model refers to this as failing faster. Although failing is never a pleasant experi-

ence for software developers failing faster means that less of their work was wasted which would never find application. Knowing these principles allows developers to understand the importance of a minimal viable product and how to introduce it. Teaching basic concepts of the lean start-up to software engineers gives them background managerial knowledge and reduces the risk of having to learn by making mistakes.

5. The significance of MVP and agile development

Prototyping is an elaborate tool not only for enabling the verification of set assumptions but also investigating different possibilities in order to create a suitable product. This method also has a role of focusing discussion on details priory neglected and formulating new proposals for development (Osterwalder & Pigneur, 2010). The minimal viable product is different from a prototype in that aspect that its goal is also enabling the start of a learning cycle. It does not have to be ideal as it is aimed at the early adopters to test if they are interested in the product and which functionality of the product interests them the most. These findings are further investigated and new iterations of the MVP are launched. Finally when you are able diagnose where the value is you will deploy a product ready for the mass public. The first Google search engine for example only gave specific results for phrases connected to Stanford University and the Linux operating system. It took them years to "organize the world's information" (Ries, 2011). One of the biggest problems engineers have with a MVP is that it is in conflict with the traditional understanding of a quality product. Software developers like the demanding environment of software development and complex tasks. There has always been a necessity to deliver quality products and that is why delivering minimum viable products and launching them to the public is sometimes a problem. However you may only deliver quality products when you are certain what your customers desire and sometimes while developing new software companies are not sure where their customer segments even are. The quality aspect is not the only uncertainty concerning the MVP. During development one tends to become attached to the product and it becomes hard to pivot to keep exploring and look for better (Osterwalder & Pigneur, 2010). Teaching the role of MVP enables engineers to embrace the concept not as a bad product but rather as what it is – a tool for learning.

An important lean start-up practice is agile development, which originated in the software industry. Unlike traditional waterfall product development, agile development consists of short development cycles eliminating wasting resources and time (Blank, 2013). Agile methods were a reaction to heavyweight, bureaucratic approaches to software development (Boyle, Cook, Windle, Wharrad, Leeder & Alton, 2006). Agile methods achieve their goals by focusing on decreasing costs and delivering value, which in turn translates to increased return on investment. Setting expectations early in the project lifecycle also allows early feedback whether to pivot or cancel the project in order not to spend too much money (Shore & Warden, 2007). In agile development

software engineers apply a project management perspective, which cannot be neglected if a method is to take effect in every day software development practices (Abrahamsson, Warsta, Siponen & Ronkainen, 2003).

Mastering agile software development requires real-world experience using a well-defined agile method such as XP or Scrum. However, prior knowledge of agile methods and a core theoretical background is essential especially if building software in a newly established company with no prior agile development experience. In methods such as Extreme Programming (XP) programmers are expected to continuously integrate their code, which enables the team to release the software frequently (Shore & Warden, 2007). This is in correlation with lean techniques however agile critics point out that the emphasis of creating product and code without clear documentation could lead to evolution of complex systems and the lack of models of software creation and integration (Turk, France & Rumpe, n.d.).

6. Teaching lean start-up methodology

Thanks to new technology advancements such as the availability of flexible cloud based hosting providers the depreciating cost of creating software based products has greatly lowered the barriers of entry for new technology companies. Software engineers see this trend especially in software product development and understand that along with managers, developers and designers are required to learn how to provide new technology that addresses needs of consumers. As one of the results we can find events aimed at teaching lean start-up techniques and raising the entrepreneurship spirit. One of these series of events is the Start-up Weekend. The Start-up Weekend is a 54 hour meeting where business, technical and design orientated specialists come together to learn how to build a product through creation. As a weekend event it starts on Friday evening when teams form and prepare projects they will be conducting during the rest of the remaining time until Sunday. Teams consist of engineers, designers and business or marketing orientated specialists. During the weekend presentations are made showing techniques used in the lean start-up methodology. These presentations usually are conducted by presenters with real-life experience in software product development. Case studies are a common technique for presenting ideas.

The learning experience however is presented during the creation of the products. Attendees are asked to use lean methods during their work and the short deadline of just 54 hours creates an even higher need to develop with lean start-up techniques. During the event a panel of experts questions the hypothesis of the teams requiring them to repeat the product build-measure-build cycle. At the end of the event all teams present their ideas to a jury panel, which then gives them feedback. This fast track teaching system has become a successful tool for bringing the lean start-up methodology to students. It provides a background from which software developers and designers without prior management skills can continue learning.

The motto of the Start-up Weekend itself is "No talk, all action. Launch a start-up in 54 hours" and this philosophy is visible throughout the event where learning through the act of creating model is strongly emphasised. Teaching managerial skills to software developers, designers and business orientated specialists during Start-up Weekend events concentrates at bringing the core concepts of the lean start-up methodology, summarised in the previous parts of the chapter, to the participants. Additionally soft skills such as presentation techniques are taught.

Following the formalisation of an interdisciplinary team, which sets to build a product during the event the teaching process begins. Experts meet with the teams and evaluate their business using the Business Model Canvass. Each section of the canvas is investigated and based on the generated information first assumptions if the product is worth building are drawn. During the next step teams start developing ideas on how to solve the business problem. Prototypes are formed and evaluated. This stage of the event introduces to the attendees the build-measure-build cycle. The evaluation is conducted by experts and is based on the cycle's unique phases where their feedback is challenging the assumptions of the team. The team's role is to get the expert's opinions also as a substitute for customer feedback. The teams use the feedback as learning data and decide to pivot and change the direction of the development or to continue work in the set path as a result a minimum viable product is built. The final element of managerial skills taught during a Start-up Weekend belongs to the soft skills family. Pitching business ideas to potential investors is a part of the ordeals almost every young technological company has to face. That is why presentation skills are taught to the software development teams during the event and that the event itself ends in presenting the product to an audience and judges. The teaching path of lean start-up techniques during a Start-up Weekend are presented in (figure 2).

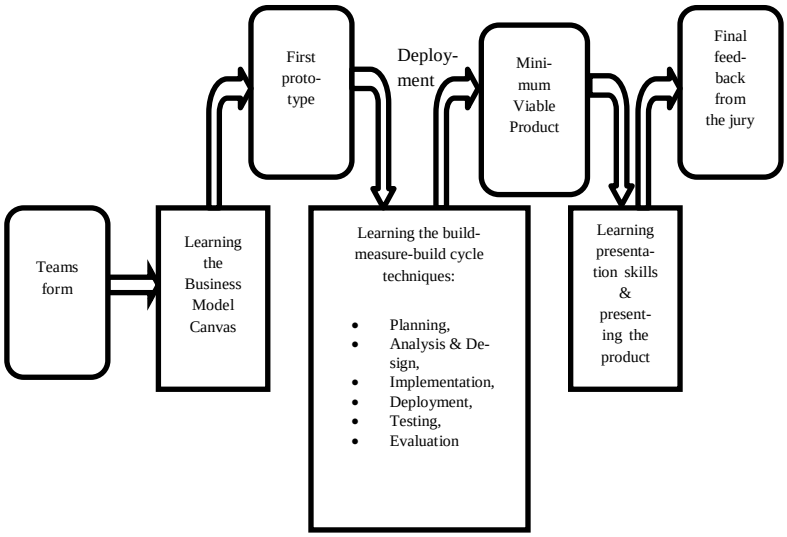

Figure 2. The path of learning lean start-up methods during a Start-up Weekend event.

45 000 software development team members have attended Start-up Weekend events around the world. Over 36% of the teams formed still continued working on their products three months after the end of the event. In an interview with the organizers of Start-up Weekend Trójmiasto it has been found that the event is popular not only among business orientated specialists but also among developers, who feel the need to learn managerial skills, especially the lean start-up methodology. Two events have taken place in Gdynia so far with an average of 70 attendees each. Around 50% of the attendees were business orientated and almost 40% were software engineers. 12 teams were created from which:

- 2 have gained investors and are currently developing their product as limited companies,
- 1 is developing their product without an investor,
- 2 have launched their applications but are not working on them,
- 1 has sold their project to an outside company.

This data shows how teaching lean development through an event like Start-up Weekend has not only learning potential for the attendees but also can create lasting projects.

The short amount of time and controlled cycles of development allow the teams to understand that failing fast is a technique that lets you achieve success quicker. The feedback given helps software developers to learn how the product influences customers and how overdeveloping could harm projects.

Learning lean methods through creating during a Start-up Weekend event has its disadvantages as it can lead to oversimplifying of the lean start-up methodology. The organisers have to emphasize on the importance of getting feedback and thoroughly analysing it as it comes. Lean methods also have drawbacks when it comes to application. Some software development, such as medical equipment software development, cannot be conducted using techniques, which use minimum viable products. This limitation has to be explained to the participants. Finally, provided the product is complex, the time span of the event sometimes may not allow producing a MVP and teams concentrate on building the product rather than on the learning perspective which may result in missing the crucial principles of the lean start-up.

The lean start-up methodology has not yet reached mainstream management methodologies however it is very efficient for software development teams and start-ups. That is why MBA programmes are adding lean methods and agile techniques to the traditional approaches to running companies.

It is clear that new ventures require their own management tools. Combining the techniques used at Start-up Weekends with traditional teaching techniques could eliminate the drawbacks of teaching lean start-up through such events. Giving a longer project scope during exercises and coupling it with theoretical knowledge provided at lectures would help the students test their products in real-life environments, being able to obtain real customer feedback together with expert opinions on the project itself.

7. Conclusions

The lean start-up is a novel method for software development and introducing it to software development teams results in higher awareness of restrictions and possible problems with product development. Managerial skills gained from the lean start-up methodology help save time and money, reduce the risk of overdeveloping or developing software unwanted by the customers. The experience of teaching lean techniques at events such as the Start-up Weekend can be coupled with traditional university techniques providing a unique practical and theoretical learning experience to software engineers. Each key element of the lean start-up methodology should be explained theoretically and further analysis of the technique could be given during the development of a project in class.

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Summary

Software development requires engineers not only to possess technical skills but also adequate managerial knowledge. Today programming skills alone are not enough, as overdeveloping caused by lack of sufficient customer input leads to loss of funds and development time. Learning managerial skills through methodologies, such as the lean start-up, brings the understanding of short cycle software development, which reduces the risks of misunderstanding project objectives.

In order to check if the software meets customer requirements the lean start-up methodology emphasises the need for product validation. As the value proposition of the product is the reason for clients choosing it over a competitive one, testing hypothesis by software developers is highly important. Gathering feedback in the lean start-up methodology is achieved by using short product development cycles. Each cycle consists of planning, gathering requirements, analysis and design, implementation, testing and evaluation. As a result of every cycle a minimal viable product is created, which servers as a learning tool for further development.

New trends in software development have led to software engineers seeking the ability to learn management skills relevant in their projects. In response events aimed at teaching lean start-up principles, such as the Start-up Weekend, have been organised worldwide. During a Start-up Weekend event participants are thought core concepts of the methodology while creating a product of their own. The event consists of all aspects of the software development cycle, leading to the development of a minimum viable product.

The events are a popular source of knowledge, with 45 000 participants to date. Although teaching the lean start-up in a short time span can lead to oversimplifying of the methodology and combining Start-up Weekend teaching methods with traditional university techniques is advised, the methodology itself is a management tool that clearly helps reduce the risk of overdeveloping products, saving time and funds.

Acknowledgements

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CHAPTER 8

Developing competences of IT project managers using simulation games

Artur ZIÓŁKOWSKI*, Kamil ZIÓŁKOWSKI**

1. Introduction

Project Management is a discipline growing very rapidly over the last 30 years. The demand for systems used exactly in every industry is a cause of increasing number of projects implemented by organizations (Philips, 2007). Therefore, the issue of IT project management concerns today not only the typical IT organizations. It is clearly visible in the financial sector, where basically every company has a dedicated information technology organization responsible for the production and maintenance of software used in the company. Similarly, in the administrative sector - each office maintains information technology department, which realizes a number of projects for the benefit of the parent organization (*the office*). This growing number of IT projects realized in organizations of most sectors of the knowledge economy (where the role of information systems is second to none) causes at the same time the demand for people who lead projects from the organizational side. This in turn causes the necessity of having the project teams built with people who have outstanding specific sets of competencies - mostly managerial and technical. These people are delegated by

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organizations to plan, monitor and control all project activities implemented in the organization. Depending on the methodology of the project and depending on the organization, these people receive suitable functions and positions. However, the literature generally calls them project managers.

In addition to the project manager, in any software project there are also other specific designed roles, which are assigned to specific functions and tasks. Depending on the methodology of the project, these roles may be different, but they are part of the composition of the project team, which is responsible for the completion of the project objectives (Orłowski, Kowalczuk, 2012).

Considering the fact that both the project manager and the project team operate under conditions of uncertainty, they must have adequate competence to adapt to the specifics of the project. The project is characterized by the fact multi-functionality (involving employees of many departments), uncertainty, uniqueness (new, unique action), temporariness and variability (both during his lifetime and from the point of view of the effect - to introduce some changes in the organization). So that, the project manager and the other members must refer their competence to these basic and universal project features (Somerville, 2003).

This causes, in fact, that the project participants must have not only professional (technical) competence, but largely just competence concerning management. They can afford to find each other in a complex project environment.

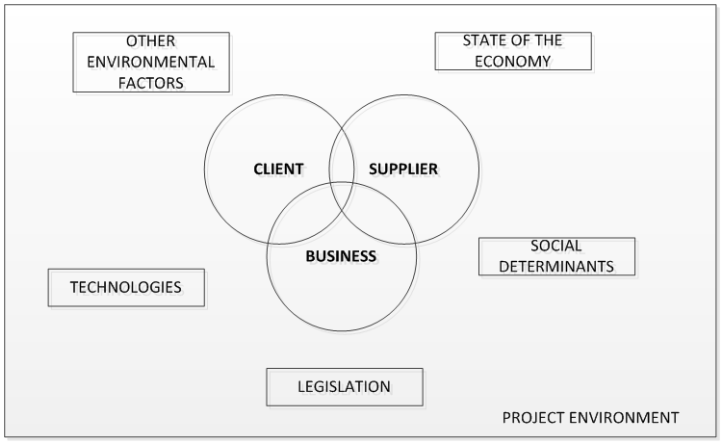

Fig. 1 Environment of the project [own based on 9]

According to the picture 1, it can be assumed that the competence of the different participants in the project should be tailored to the project environment. This is particularly important in the area of IT projects, where the e.g. intensity of meetings with the client and variability of requirements are much higher than in other industries projects.

Precisely, the need to have appropriate managerial competencies has caused increase the interest in formal project management methods that develop these competencies. IT organizations are investing in the development of their employees providing

them opportunities to learn about contemporary popular methodologies used in project management (e.g. Rational Unified Process). Mainly to give them opportunities to find themselves in dynamic and specific project environment.

Based on the above description, it should be considered that the development of managerial competencies is important from the success of the project point of view. All people involved in the project should understand its specificity and have knowledge that only technical skills do not guarantee the success of the project. Therefore, in the education market - in the university's offers and dedicated training centres and even individual firms - all sorts of forms of training allowing management to extend the competence of project managers can be found.

To popular forms of development of managerial competencies in the area of project management it should be included e.g. dedicated specialties realized at various levels of study, dedicated postgraduate studies in the field of PM and certified training in PM organized by *training* companies. Often enough main leadership of information organization decides that all companies should go on systems of work compatible with formal PM methodologies. Then they organize not only single trainings, but total programs of developing management competences of their employees.

Market demand for training services providing specialist management knowledge in project management has forced organizations to customize the education sector, or even the creation of a whole new *training* program in order to develop managerial competencies connected with the needs of IT project management. Simulations of projects have become one of the more popular ways to develop managerial competencies. Education related with simulation allows for quicker understanding of the PM including the audience (students, trainees) by unassisted making decisions and observing the consequences of managerial and organizational decisions. Simulation environments should be understood not only in the *computer way*. Very often, the simulation environment of project is a manager game, which aim is to reflect the possible events in the project.

The purpose of chapter is presentation of example how project managers' competencies can be developed by participating in the simulation game, which concerns the chosen project management methodology. The example described in this chapter is based on a simulation of an IT project in accordance with one of the most popular methodologies used in the management of IT projects - Rational Unified Process (RUP).

The rest of the chapter concerns also the other, common methods used in the IT industry, with particular emphasis on the development aspect of managerial competencies. This presentation shows the wider context of the need for competence in project management in the IT industry. The last part of the chapter affects the discussion of sample simulation game and the presentation of the effects of study after use of the game in the student's education.

2. The role of project management methods

Project management methods are sets of best practices and guidelines related to the conduct of projects. Basically, they are divided into classic and agile. The main criterion for this division is participation of planning processes. Classical methods are those where planning processes dominate. Agile methods put more on the self-organization teams.

Increasingly, the methods are also classified as managerial and productive. In this case, the criterion for classification is the participation of management processes. In the case of managerial - participation management processes is naturally bigger and activities are focused on ensuring adequate control of all processes. The productive methodologies answer not only a question: what something should be done? - but also how (providing the most sets of tools supportive for the project's effect - designed product).

However, regardless of classification, it should be considered that the role of formal, written and documented methods of project management is essential in preparing employees or students to perform the role of project manager or a member of the project team. Project management methods relate very clearly to the aspect of project management, both at a high (organizational) and lower (e.g., the project team) level.

Other popular methods currently used in the management of IT projects include PRINCE2, PMBoK set of good practices, methodology of software projects RUP and very popular SCRUM agile approach. Each of these methodologies can be classified into one of the divisions' *classic-agile* and *management-productive*. However, in this chapter, this classification has secondary importance.

It is more important to indicate that each of them refers to the specific competencies that project manager or a person performing a leadership role in the project should have.

The following characteristics of these methodologies used in project management will emphasize the role of managerial competencies required in conducting IT projects.

PRINCE2 is a project management *anywhere* method (not just IT), but its roots embedded in the IT projects. The principles of this methodology based on many years of experience and there is formal (procedural) approach to PM connected with them. So that, during analyzing the PRINCE2 approach to project management, people should look into the recommendations of the high-level-business(principles), formal guidelines for project development(processes) as well as aspects that require continuous monitoring (PRINCE2 themes). PRINCE2 method is different from other methods because of its very clear standardization (PRINCE2, 2009). Method contains a number of descriptions regarding the structure of project team, as well as full standardization of the processes of the project by main stages and steps in the individual stages. In addition to a fairly rigid framework related to the organization of resources within the framework of the project implemented by the PRINCE2 method and recommendations for accurate planning the method PRINCE2 focuses largely on the role of the client.

Customer according to the method PRINCE is part of a complex organizational hierarchy of the project and is positioned at the top of the hierarchy. In contrast, the project manager has the organizational and controlling function in relation to the different stages, but he is subordinated to the supervision of the steering committee. Hence, understanding of management processes for project managers realized by PRINCE2 is essential.

The second set of best management practices, which project managers date back to, is PMBoK (Project Management Body of Knowledge). PMBoK is a compendium of knowledge about project management (PMI, 2008). PMBoK very precisely defines the main stages of each project and distinguishes main areas, which the project manager should deal with. PMBoK includes inter alia: management project integrity, scope management, time management, cost management, quality management, human resource management, communication management, risk management, procurement management and stakeholder management. As is clear from this description, the manager is expected to understand a number of aspects of management, hence its competence in these areas are essential.

Rational Unified Process (RUP) is a project management method classified in the group of classical (heavy) methods, in which participation of planning processes is significant. The method was based on the experience gathered information project managers around the production environment Eclipse (Kruchten, 2004; RUP documentation). The primary task of the RUP method is to determine how to implement projects and create a working framework for the managers of these projects. Hence, the main recipients of the recommendations contained in the method of RUP are managers. However, RUP method can provide the knowledge base for IT projects also for other members of the project team. It contains a series of guidelines for business analysts, developers and testers.

RUP can be broadly divided into two dimensions of management. Each of them contains a specific project good business practice. The first dimension relates to the strategic and tactical operations and set of good practices within the 'critical guidance to business-oriented production' should be included to it. The second dimension is the equivalent of planning for the operational level - it can be understood as a method of performing a particular task design, organizing a team and managing project documentation. Understanding implementation process and workflows or defining the products work are expected from the project manager here. It requires possession appropriate managerial competences.

SCRUM, in opposite to the previously described heave methods, belongs to the category agile (light) methods. These methods are characterized by more flexibility and resistance to change than in the case of heavy methods (Chrapko, 2012; Schwaber, 2004). The light methods also minimize planning processes, because of more emphasis placed on action(execution of tasks) in possibly short cycles, after which already made steps are verified and another are designated. In this method three areas of good prac-

tice in PM should be pointed. The first good practices are focused on managing the team. The second area is practice-oriented in task management/scope of the project. The third area is a good practice focused on the preparation of documentation. The following briefly characterized these areas to choose from - just as it did previously - six good practices that will form the basis for the selection of aggregated decision variables. In this method, the role of a project manager is not typical, but all participants must exhibit a number of managerial competencies - planning, estimating, division of labour, etc.

The aim of this analysis was to present the characteristics of each project management methodologies. As follows from the above considerations, each of the methodologies refers (more or less) to the problem of understanding of the project environment. Referring to the introduction of this chapter, where attention was drawn to the environmental characteristics of the project (variability, versatility, temporality, etc.), it must be recognized that project management methodologies provide the knowledge necessary to understand this environment. According to that, the competencies of project managers often develop through training within the specific project management methodologies. Each of these methodologies has its inherent set of good practices and guidelines for project managers, but each of them at the same time highlights the typical features of each project environment.

It should be emphasized that both universities and training companies take into account the need for education of project managers and project team members in an increasingly cross-cutting. Of course, some subjects at universities and educational training packages companies are still focused on a specific methodology (for example, applies a given parent organization), but due to the fact that there is no single dominant methodology, and more and more talk about adaptive approach [*footnote to the chapter*] in project management. An adaptive approach consists in selecting those best practices that are grounded in a specific project. Such an approach is a kind of prevention against unthinking use of methodologies mismatched to the specific organization or project. It also allows choosing the best, fitting in common today stream of tailored ("bespoken") solutions. However, the need to adapt methodologies to the specific project, requires appropriate skills and knowledge of project managers. Hence, the processes of education in project management are developing very rapidly. Exercises in project management do not only rely on the acquisition of knowledge but to a large extent on strengthening and developing the competencies that will later be used in real projects. Therefore, besides the classic lectures, both at universities and in training companies, there is a growing emphasis placed on two aspects - learning on the basis of case studies and learning based on games simulating the environment of the project.

The first of these two aspects concerns the analysis of past projects and showing what decisions a project participant could on the manager premises take. Then the coach / teacher evaluates the decisions and in most cases translate what should be done in accordance with the principles of the methodology.

The second of these "new" methods of education managers is the use of simulation games. These games are the most certain simplification of the project environment, where they can systematically observe the effects of taken decisions. Simulation games can have a computer dimension - provide a virtual environment, but in many cases (as in the example described below) they are a set of data supplied to the participants of the game, represent the state and later - by the decisions taken - the participants make changes to the project environment and observe the effects of that decisions. Such games can be done only with using the control documents (e.g. plans), but also can include props, which will be reflected in real projects (such as building a tower of blocks). Regardless of the type of game simulation, the most important is to highlight the need for specific management competencies that are essential for the subsequent management of the project. The next section of chapter shows a typical set of managerial competencies, which are now required from project managers.

3. The need to develop managerial competence

The above considerations evoked the need for managerial competence. In this section basic competence that seems crucial to manage any project will be discussed. The following competencies, actually - categories of competence (which of course can be decomposed into individual skills or even ability) should realize that training for project managers should - at any point - refer to any of these categories. The following set of categories is not merely a result of project management methods (although each of them refers to most of the above), but also is supported by observations and research conducted by the author of this chapter. Detailed results of the follow-up projects are not so important in this case. More important is an indication that the project management and organization of project team require specific managerial competencies from managers.

One of the core competencies required of project managers is the **ability to plan**. Regardless of the type of methodology adapted to the project, the planning process will be one of the fundamental. Its intensity will be different (e.g., Scrum sprint planning is the responsibility of the team), but this ability will be crucial for the course of the project. Project managers and team members always have to plan certain things before they join the action. Depending on the project, it could be planning the entire project or just the next step, or even the tasks of the working day. But every time it will be necessary to have the competence to prepare a clear and understandable plan of action.

The second competence, the key especially from the perspective of the project manager, is the ability to monitor and control. This ability may be needed to verify the previously prepared plans and to monitoring progress of project teams work.

In today's education project leaders also committed to develop competencies allow for the sharing of power possessed what is often called **"delegation of powers"**. Project managers should be able to delegate powers to individual members of teams or

team leaders. They must be able to provide them with a "freedom of decision-making" without losing them power. Hence, it becomes necessary to skilfully divide tasks and to specify how the project should work.

Ability of communication is typical of skill required in any kind of business activity, not just in PM. However, in the case of IT projects, communication takes place mostly in the customer-supplier relation. This requires the ability to communicate business issues to the *production* team, but it also requires the ability to communicate technical issues to the business side. Therefore, education in project management often concerns communication aspects.

Ability to work in a team is a competence that allows increasing of the efficiency of the project team. Undoubtedly previous competence (ability to communicate) is a part of it. But with regard to the projects, thinking about working as a team, there is need to highlight the aspect of skilful finding out in a structured team. Project management methodologies relate very clearly to the project team, defining individual roles casting range of responsibilities (the structure of roles and team in PRINCE2 is another and also there is another in RUP, SCRUM). Hence, this competence should be understood more in the methods dimension than in so-called soft skills. Ability to work in a team in this case is the understanding of the work of the project team, depending on the methodology of project management, types of hierarchies and rules for the submission of documents or work products.

In turn, the **ability to make decisions** for project managers is a skill on many aspects of the project. It means that they can concern skills for the approval of plans, but also the delegation of powers or even the selection of team members. This category is - in some ways - superior to the previously mentioned. However, during and after management training, manager should know how to assemble the benefits and losses resulting from the decision, analyze the project environment and to predict the effects in the environment resulting from the decisions taken. Therefore, training in this area is to strengthen the analytical skills and the relevance of the action taken.

The last category worth mentioning in the education of managers is **developing competencies related to matching to the changing conditions of the project.** Most often this competence involves the ability to adapt to change, emergency operations, response to threats and opportunities emerging project and the ability to function in a dynamic environment of the project. Training in this area refers primarily to cope in the face of risky events occurring in the projects.

Of course proposed above set of competencies can be developed for a range of both 'soft' competencies and technical skills. However, it is important to remember that this set was emphasized on the need of educational processes of project managers. The table below shows how the different methods while project management support and require specific expertise.

Table 1 Mapping competences on project management methods

	PRINCE2	PMBoK	RUP	SCRUM
Ability to plan	Application of the methodology requires skill above all in the planning stages of the project	It is assumed the necessity of preparing the project plan	Methodology establishes plans of each iteration during preparation of a product (software)	Metodyka wymaga umiejętności planowania sprintów, czyli krótkich intensywnych etapów wytwórczych
Ability to monitor and control	The methodology requires the ability to view reports and draw conclusions. This is especially related to monitoring products and project risk	This approach requires knowledge of techniques to monitor and control the progress of the project	The methodology requires the ability to control, especially in the area of supervisory quality management.	The methodology focuses on providing customers browsing the effects of ongoing work.
Ability to delegate powers	The methodology draws particular attention to the hierarchical relationships in the project management team	PMBoK approach allows complex structures design and thus hierarchical rules.	The methodology allows hierarchies in a team responsible for the project.	The methodology assumes that the owner of the task is the whole team, so the delegation of powers in this regard does not occur. But it is necessary to divide the work within the team
Communication skills	The methodology requires, inter alia, develop management strategies across the public	Communication is one of the key areas which must be dealt with throughout the duration of the project.	Methodology refers to the strong cooperation both within the team and with stakeholders.	The methodology involves the cooperation of both the band and cooperation with the customer. In both cases, the ability to communicate is needed.
Ability to work in a team	Project management team has a complex structure, there are skills discovered in that structure, that are required.	This approach provides basic recommendations for group work. Project definition is based on the work of the team	The methodology involves a multi-level team with clearly defined roles. The role is responsible for the execution of tasks and work product that is the result of the task.	The methodology focuses on the self-organization of the team. Teamwork is a basic skill
Ability to make decisions	The methodology is based on the validation of individual documents	This approach refers to the necessity of making a decision mainly by the project manager, person, who is responsible for the implementation of the project.	The methodology considers the project manager as the main decision-maker.	The team decides which tasks execute at a time. It is skillful decision when and what to do.
Ability to adjust to changing conditions	The method extracts the key themes of "change" and "progress"	This approach treats the project as a dynamic environment, so the change is a common occurrence in the project.	Methodology refers to the variation by defined discipline, "environment"	The methodology assumes a high adaptability to change, so each participant should be accustomed to changing conditions.

Source: own work

This statement emphasizes the need for education of project managers and project team members in key areas of competence, which possession influences at efficiency

of work in project environment. However, the acquisition of the above-mentioned competence is not an easy task. It requires not only assimilate knowledge of the methodology, but also acquire experience. Experience can be purchased during the course of work on the project, but a certain base level should be provided during training in the various methodologies. So that, in the education of project managers, simulation projects allowing to generate specific competence in practice have become very popular. The rest of this chapter demonstrates how simulation-based education project by one of the above methods - Rational Unified Process.

4. Simulation games in the development of the competence of project managers

Simulation games used in education in the field of project management are simplifications of project reality and they are designed to support the development of core competencies in the area of leadership (as described earlier). Some games support only certain powers; others may refer to the general competencies required of project managers and even members of the project team. Simulation games are usually developed in accordance with some methodology and relate directly to the features of this methodology. The following table shows examples of how simulation games help to develop data management skills. Many of these games have a representation in the form of dedicated electronic tools, which keeps track of the effects of their decisions. However, many games are primarily organizational-management games, where the project reality is simulated by props (chapter, pads, etc.). Engagement in the tasks assigned the participants is important issue there.

There is presented one selected simulation on RUP methodology in this chapter. This is due to many years of cooperation of the team operates author of the chapter with IBM Poland - the owner of the copyright for methodology. From 7 years IT project simulation according to the principles of RUP has been adapted for classes in project management at the Faculty of Management and Economics and the courses conducted outside the Technical University of Gdansk, resulting from the collaboration with IBM.

4.1 Simulation rules

Simulation game "Project Management by RUP " is a game that does not require using information systems. Its purpose is to simulate two basic phases associated with the production of software. Description of the project situation and a set of materials (documents) necessary for making management decisions are supplied to the participants. The main product delivered by teams of 3-4 members is a prepared iterations plan. This plan includes all the main features of the project (refer to design constraints) and requires specific decisions for RUP methods (e.g. selection of the team due to the role and discipline of the RUP).

It should be noted that all participants in the simulation are responsible for management decisions. The team does not simulate the product process - it only decides which tasks will be executed in a given iteration. The simulation assumes a simplification that the decision on the execution of module A of IT system means the execution of the module as a whole. The role of the participant in the simulation is to estimate the cost, the duration of the implementation of the functionality depending on the planned number of operators.

This simulation is therefore to focus more on the use of management mechanisms than on aspects of production. The participants are accountable for the decisions with their result in changes in the schedule, budget and scope of the project.

5. The Game

The simulation project should be divided into several key stages. In the first step the participants (3-4 person groups) read the guidelines for the game and the description of the project for which they will make decisions. They then receive additional guidance on how to estimate the time of the tasks and costs resulting from the decision.

During the simulation, participants receive information about the changes to be included in the project. In addition, risk factors and random events that affect the project are simulated too. In view of the risk and random events, participants take certain decisions to resolve problem situations.

Teams participating in the simulation iteration prepare a plan in accordance with the model provided by the coach. Below there is an example of a plan of iterations used in the simulation:

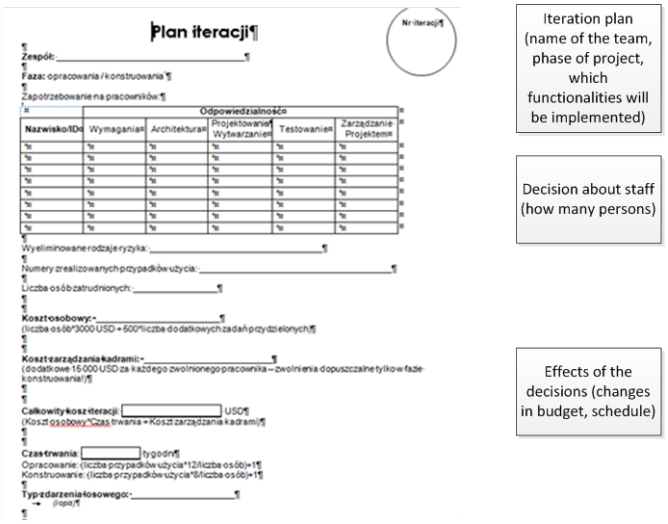

Fig. 2 Iteration plan prepared during the RUP simulation game

Presented iteration plan is a form to check the ability of making decisions about the project.

At the end of the game there is important issue to check: the decisions made by the participants (the main question is: did they allow meeting the set budget, schedule and scope of the simulated project?).

5.1. Terms/conditions of simulation

The above simulation game takes place in the framework of the boundary conditions that participants should not exceed. Exceeding these conditions has the effect - admitting penalty points - lowering score of the team. Boundary conditions relate to, among others, the project budget, the number of persons employed for the project, the duration counted in weeks or scope of the system (calculated by the number of functions / modules). The condition of the simulation is also structure of the RUP methodology, which recommended realization of the project with having respect to the project phases and disciplines. Simulation is focused on two phases of production - elaboration and construction (development and production).

5.2. Learning outcomes/effects

The above simulation game significantly affects at the development of key leadership competencies of project management discipline. During the simulation, participants face the issues of management in terms of volatility. They are watching how management decisions translate into changes in the budget and project schedule while learning the specifics of the RUP methodology. The following table presents the simulation project supports the development of individual competencies.

Table 2. Project managers' competences developed durian simulation games

Competences	Description
Ability to plan	The simulation imposes participants to plan the various stages of the project - iterations. The team fill iterations plan, where it assume which tasks will be executed in a given stage.
Ability to monitor and control	Participants of the simulation during the game have all the time to monitor changes in the budget and schedule and monitor whether all the assumptions are met.
Ability to delegate powers	Team during the simulation receives a number of unexpected extra tasks. To do them, they have to share work between members of the team.
Communication skills	Participants of the simulation need to exchange information all the time, especially that during the simulation there appear additional information necessary for the project.
Ability to work in a team	Participants of the simulation must cooperate in the planning stage and risk management. They must at the same time develop plans together, setting the course of iteration.
Ability to make decisions	Participants of the simulation make decisions on the level of employment and the number of tasks in one iteration.
Ability to adjust to changing conditions	Participants receive additional information about the random events that require changes to the approved plans.

It results from the table above that the simulation of the project refers to the core competencies of project managers. Participants during the simulation are faced with a

sufficient number of aspects referring precisely to these key competencies. In addition, they can regularly check the effects of the decisions taken in the course of learning the game. The best evidence on the effectiveness of learning in the course of the game is the fact that the preparation of the plan participants first iteration takes about an hour, while preparing the third or fourth iteration takes only 10-15 minutes.

6. Ratings of participants

The last thing that is worth to noting finally at the end of this example is the satisfaction of the participants. The information gathered from the surveys conducted at the end of a full course of project management showed that participants evaluated the cycle is the best simulation game. The chart below shows the rates of the PM course members (5 was maximum mark). The course was realized among the students of university.

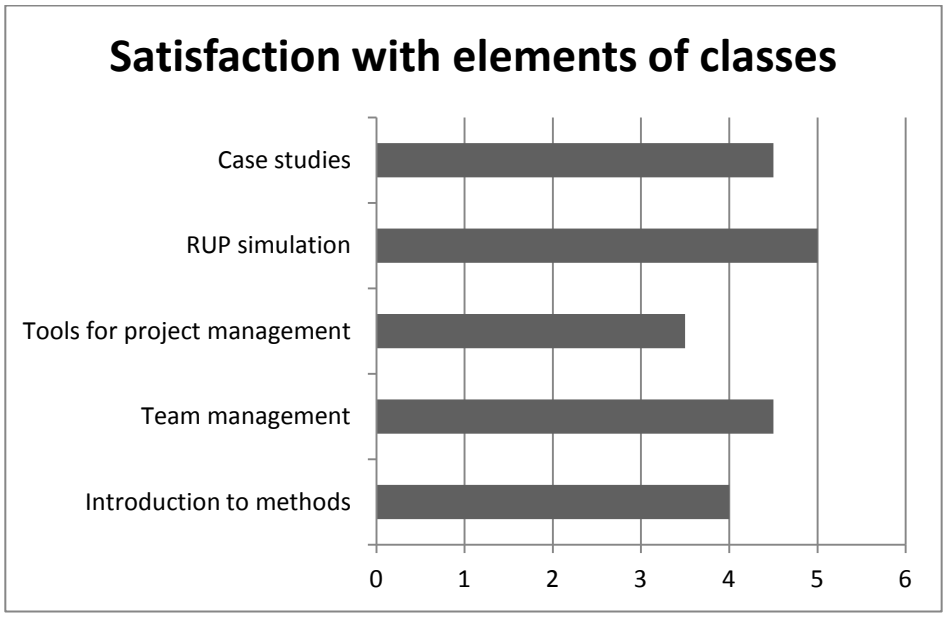

Fig. 3 Satisfaction of students participated in project management courses [own]

Very positive experience of participants on simulation is confirmed by the fact that they give the game positive rates even if the results are far from assumptions (budget overruns and schedule).

Most of the participants stated, that they will take other decisions if they can pay once again. This is also positive occurrence. Learning from the mistakes of the simulation is cheaper than learning from the mistakes of the actual, real project.

7. Conclusions

The purpose of this chapter was to share the experience gained through the use of simulation projects in the education of project managers. In the first part, there was a reference to project management methodologies. Then it was indicated that the key managerial competencies should be developed during the training. This analysis was necessary to indicate that the individual competencies are strongly supported during the games that simulate the environment of the project.

The conducted study about the level of satisfaction of the participants has shown that simulation games are the most popular among participants of such courses.

Presented chapter shows that practical aspect is very important for the training of project managers and project participants. Despite the fact that simulation games simplify reality, the reception of such games by their participants is very positive. This means that for project managers aspect of simulation games is one of the most important in training courses.

It is worth noting that the team, which author of this chapter belongs to, is working for a long time to reflection the environment of the project as completely as it is possible. When identification of the key areas of project management, identification of basic types of project environment (which was shown in the Picture 1) were already made, the next part was to proceed to modelling computer environment of project's simulation. In mid-2013 there was developed (Orłowski, Ziółkowski, 2010) a prototype agent-based environment for IT simulation projects. The development of this environment contributes, *inter alia*, at education of project managers with particular emphasis on good practices from various project management methodologies.

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Summary

Project Management is a domain in which methodological approach is developing very rapidly. Project managers are required to present knowledge of the various methods of project management and apply them to the management of specific projects. It means that project managers must constantly develop their competence, mainly based on good practices from different formal methods of project management. The purpose of this chapter is to demonstrate the possibilities of education of project managers through the use of simulation games. The chapter presents some good practices related to the development of managerial skills project managers using simulation games. Therefore, on the beginning of the chapter, author presents some examples of simulation games related to popular methods of project management. One of the simulations concerns the classical approach - RUP, second relates to the agile approach. The second part of the chapter includes a set of competencies of project managers and then shows how these competencies can be enhanced by participation in such simulation games. At the end author presents a set of observations and experiences based on few project simulations carried on over several years.

CHAPTER 9

Cloud solutions as a platform for building advanced learning platform, that stimulate the real work environment for project managers

Sebastian WILCZEWSKI *

1. Introduction

Improving skills of managers and executives require, that during the transfer of knowledge (in different ways: during studies, trainings, workshops and other forms of education) it is necessary to use tools and solutions that are (or will be) used in real world environments, where people being educated are working or will work. Cloud solutions allow educational entities (universities, training companies, trainers, etc.) to provide advanced IT solutions, which reflect actual or future work environment of trained managers, regardless of the level of complexity of the environment. It is alternative for on-premise installation.

The purpose of this chapter, is to analyze the capabilities of cloud solutions, their suitability for building workshop environment (reflecting real, business IT environments), and the ability to use these solutions in distributed environments (geographically spread and international groups). It will be made on example of two cloud services: Project Online and Office 365, which could provide a platform for build workshop to develop competencies related to the management of projects and programs for future project, program and portfolio managers.

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2. Aim, sources of data and information

Observing the growing popularity of cloud services (i.e. providing software as a service), the author of this chapter will examine whether they permit to solve the all mentioned in this chapter challenges. The author will be peeling on their own practical experience under about 10 years of practice in the implementation of project management systems. Data in this chapter come from about 10 implementations of Microsoft Project Server and Microsoft Project, in which author had participated.

The author of this chapter lectures on project management and computer laboratories in the field of project management support, using Microsoft Project Server and Microsoft Project. In addition, he has about 10 years of experience in implementing project management methodologies and IT systems for project, portfolio and program management. Therefore, searching for answers to given questions, the author will be focusing on providing expertise in project management and IT systems relating to this area of knowledge.

3. Applied research methods

Researches will be carried out on the example of Microsoft Project Server and its counterpart shared as a service (Project Online). In the first place resources necessary to implement these solutions will be identified. Specific software licenses are required (both – for the server software and client) hardware resources (only for servers), and competence, as well as the time needed for projects implementation. Then analogous estimate will be made in the event of solution delivered as a service (Online Project and Project Pro for Office 365). Both deployment scenarios will be compared. Their advantages and disadvantages not only in implementation, but also in the field of maintenance will be shown. This will allow assessing which of the solutions (on-premise or software as a service) can be used at universities and in what situations they can be used. Alternative method of delivering IT systems will also be described.

4. Problem statement

Typical methods of delivering theoretical knowledge for managers are lectures, classes, workshops, etc. They allow lecturers to provide the necessary theoretical knowledge and information to trainees (students). Typical resources required for this type of activity are (apart from the person and knowledge of the lecturers, which are obviously a key element) lecture hall, equipped with presentation tools (including multimedia resources), and teaching aids. They can help to provide essential knowledge and facilitate its memorization. These resources allow you to conduct lectures and provide knowledge (lessons) in different areas (including knowledge about project management). They can be repeatedly used for many types of training. Their lifespan is also long. For example, one well- prepared lecture hall allows conducting lectures in

various fields for several years (after a possible retrofit in new media resources - if necessary). So this resource is universal and relatively durable.

However, conducting computer workshops (laboratories) require additional key resources. These are computer rooms (with the appropriate software installed) with access to information systems, the use of which students will be trained. The author of this chapter while his professional and scientific work and teaching provides knowledge for current and future managers who want to improve their skills in project, program and portfolio management. He noted that in addition to theoretical knowledge (in the appropriate area), the trainees must acquire the ability to use computer systems and applications that they will use in their future careers. Educational service providers (including universities) should, therefore, be equipped with training environments, allowing carrying out activities, in the form of computer labs. In these laboratories, IT solution (which [in the future] will be used by students - both full-time study, part-time and postgraduate - during work), should be installed. IT systems mean applications and server solutions.

The level of complexity of these systems (e.g. systems for project management, systems for customer relationship management, document management system) increases, and the qualifications needed for their implementation are getting higher too. The number of systems which are used in business organizations is also increasing. There is a challenge behind organizations providing knowledge, how to provide (with limited resources - money, personnel, competency, computer equipment, etc.) the trainees with knowledge, how to use most advanced systems and solutions. However, universities do not have extensive IT staffs and budgets that may take care about the implementation and maintenance of a number of complex and elaborate systems.

According to these considerations we can give some statements:

- IT systems dedicated to support business decisions are now more complicated than they were 10 years ago and effort needed to implement is much higher than it was
- you need to have specialized IT stuff to install, configure, maintain and customize this kind of specialized systems
- buying and maintaining of IT systems (implemented on premise) can be expensive - especially looking at initial costs.

After this we can identify following (common issues):

- how to get enough employees who are able to install, configure, and maintain unique IT solution?
- how much they will cost?
- is it profitable, if we are using software for half a year, but we are paying full price?
- are we ready to maintain so wide range of software (with reasonable SLA)?

There is the main question: how institutions providing knowledge (including universities) can deploy and maintain complex systems used by business organizations to be able to train students in the field of using these systems.
The author of this chapter will look for answer for this question below.

5. Research results

Seeking answers to the main question, the author has identified that implementing systems you can opt for one of following four scenarios:

- **On-premise installation** – in this scenario, an educational institution decides to install software on their own servers. With this solution, it is necessary to purchase software licenses (also in the case when you get a new version). The effort associated with installation, configuration, adapting and maintaining the solution is directly on the educational entity.* .
- **Infrastructure as a Service (IaaS)** – in this case, the institution decides to lease the equipment (from the service provider), on which implemented software will be installed. The service provider will be responsible for hardware maintenance. However, the complete process of installation, configuration and adjustment of all software will execute the educational institution itself. Educational entity will also be responsible for software maintenance and should ensure an appropriate level of service for the software (not hardware). In this approach university, can reduce the initial costs associated with purchasing the equipment, but in the long run it may turn out that the total costs associated with the lease will be higher than the total cost of purchase and maintenance of hardware.
- **Platform as a service (PaaS)** – here the operator decides not to lease only hardware, but also the basic software (such as a server operating system – Windows Server for example). On these leased items entity will install the main business system (which may be for example Microsoft Project Server). Licenses for the main system, the educational entity acquires itself. Just like Infrastructure as a Service, Platform as a Service allows you to reduce initial costs and replace them with spread payments. The longer the period of use of software, the solution may be less cost-effective.
- **Software as a Service (SaaS) and cloud solutions** – in this scenario, an educational entity buys a comprehensive service (software as a service), under which it receives access to specialized software (installed in the cloud, and hosted by service providers), which can be used as long as you pay for it. Responsibility for maintenance of the system, and delivering services on appropriate level lies on the service provider, however, adapting the software to business require-

* Installation, configuration, customization and maintenance solutions can be delegated to other entities, but does not substantially alter the effect on the analyzed issue.

ments must be performed by the customer, on his own. Project Online is an example of solutions in the computer cloud delivered by Microsoft. It supports management of projects, programs and portfolios of projects (it is the equivalent of Microsoft Project Server, implemented in the on-premise model). This cloud can be used by educational entities wishing to teach students to use project management software, but not having own IT staff, which will be able to install, configure, and maintain the appropriate software. Hiring Project Server in the cloud computing by Microsoft (Project Online solution) is not the only possibility. Some service providers supply this software under SPLA (Service Provider License Agreement) licensing model, which is cloud solutions to. But in this situation solution in the cloud is provided by a different provider than Microsoft. Licensing models and fees associated with the cloud delivered by Microsoft and other suppliers may be different.

Summary, which is comparing models described above is showed in the table 1.

Table 2. Responsibility for different aspects of implementations IT system in different implementations scenarios

<table>
<tr><th></th><th>On-premise</th><th>Infrastructure as a Service (IaaS)</th><th>Platform as a service (PaaS)</th><th>Software as a Service (SaaS) and cloud solutions</th></tr>
<tr><td>Hardware (servers) and hardware maintenance</td><td>University (or different educational entity)</td><td colspan="3">Service Provider</td></tr>
<tr><td>Hardware (clients hardware – workstations, tablets, thin clients, etc.) and hardware maintenance</td><td colspan="4">University (or different educational entity)</td></tr>
<tr><td>Software licenses (operating systems and core systems)</td><td colspan="2">University (or different educational entity)</td><td colspan="2">Service Provider</td></tr>
<tr><td>Software licenses (main server applications)</td><td colspan="3">University (or different educational entity)</td><td>Service Provider</td></tr>
<tr><td>Installations and configurations (operating systems and core systems)</td><td colspan="2">University (or different educational entity)</td><td colspan="2">Service Provider</td></tr>
<tr><td>Installations and configurations (main server applications)</td><td colspan="3">University (or different educational entity)</td><td>Service Provider</td></tr>
</table>

Maintenance (operating systems and core systems)	University (or different educational entity)	Service Provider
Maintenance(main server applications)	University (or different educational entity)	Service Provider
Customization	University (or different educational entity)	
Service level agreement (SLA) - (operating systems and core systems)	University (or different educational entity)	Service Provider
Service level agreement (SLA) - (main server applications)	University (or different educational entity)	Service Provider

Further analysis will be done only on two deployment scenarios: On-premise and Software as a Service (SaaS) -cloud solutions.

At the begging it is necessary to identified licenses needed to implemented solutions in both scenarios. Self-made implementation of the Microsoft Project Server requires the installation and purchase of licenses for the following software:

- **Windows Server** - a server operating system, allowing the installation of other software, required for implementation. It should be installed on as many servers (of physical or virtual), on how many whole solution will work. The author of this work, on the basis of their experience, claim that the environment used simultaneously by 50 project managers require one or two such servers.
- **SQL Server (with SQL Reporting Services)** - is a database solution, in which analyzed server stores data about the projects and related items (such as documents, issues and risks). In environment in which works simultaneously 50 project managers, one such server is usually required.
- **SharePoint Server** (with the functionality available in the Enterprise version) - this is a server application for managing workflows, document workflow and connectivity with other applications. It is required to properly install and configure before you may install Microsoft Project Server. In environments that support up to 50 trained project managers, the solution is typically installed on a single server.
- **Project Server** - a solution implemented on a stack of all the previously mentioned server solutions. Similarly, as previously defined solution, for the implementation of 50 project managers requires only one server.

- **Project Professional** - is a client application used by project managers and installed on their workstations. It generally requires the installation of as many as there are project managers.
- **Client Access License** - those software requires the purchase of appropriate client access licenses to be able to use the software specified above

For using software in software as a service model, it is required to purchase the following services:

- **Project Online** - this service allows you to use the capabilities of Microsoft Project Server. As part of the purchased service the client is also able to use all the systems necessary for the operation of platform (including Windows Server, SQL Server, SharePoint Server and appropriate client access licenses)
- **Project Pro for Office 365** – this service allows you to install Microsoft Project Professional on a workstation and use it as long as the service is paid. Cessation of payment of services implies the need to uninstall the related software.

Cost categories:

- **Cost of software** – these costs include the price to be paid for the licenses for servers. These costs are only for on-premise model, as in the case of cloud computing software there is no payment for licenses
- **Cost of hardware (only servers)** – included here is the price of the servers (hardware). This costs are not applicable for software in the cloud, as it is available on the servers of the service providers
- **Costs of maintenance** – these costs represent the costs of systems maintenance (e.g. backup, install, update the costs of the personnel responsible for maintenance of the system). They occur only in the case of software implemented in the on-premise model. They should be analyzed in a given unit of time. They do not occur in Software as a Service mode, because they are directly included in the price of the service.
- **Cost of service (per year)** – this cost is only paid in Software as a Service mode. This is main component of the implementation in the Software as a Service model. The longer the company is using the software, the cumulative cost of the service is greater. After specific period, they may exceed the one-time costs associated with the implementation of on-premise software.
- **Cost of customizations** – These costs are related to the necessity to adapt the software to the requirements of the organization. They take place in both models (SaaS and on-premise).

Estimated prices, based on knowledge and experience of the author of this chapter are listed below. They may vary depending on the discounts which can be given by the supplier. They also depend on the manufacturer's licensing policy. The estimated here are licensing costs and services dedicated to educational institutions.

Table 3. Estimated costs of Cloud Solution vs on premise installation

	Cloud solution (Software as a Services) – Project online	**On-premise installation (Project Server)**
Cost of software	0	17 000 Euro
Cost of hardware (only servers)	0	5 000 Euro
Costs of maintenance	0	May vary
Cost of service (per year)	6 600 Euro (Estimated)	0
Cost of customizations	This same or similar	

Analyzing costs listed above, you may notice that in the case of software in the cloud, you will pay only charge for the service. They are distributed in time. There are no large, one-time payments. In the case of software implemented in on-premise model, there are brought large one-time payments (at the beginning) and minimum costs paid periodically. In both cases, it is required to pay cost of adapting the software to suit your needs. The main factors influencing the choice of a particular model are thus:

- the willingness and capacity to pay one-time fee vs. spread payments
- having qualified IT staff vs. ensuring maintenance by the service provider,
- the desire to have the software and hardware vs. using the service for specific period of time.

It should be also noted that there is no significant functional differences between the software deployed in the cloud and accessible software on their own servers.

6. Conclusions

Referring to the main question (given at the beginning), and basing on the analysis of available deployment scenarios, it is possible to identify the reasons for selecting appropriate implementations model (on-premise or cloud solutions). Those reasons are discussed below.

Implementation of solutions in on-premise model is supported by the following evidence:

- the organization has or is able to quickly acquire and maintain the servers on which the systems will be implemented,
- the entity is able to pay one-time large expenses related to the acquisition of software licenses,
- the entity has competent resources (in the right amount), which are able to install, configure, customize and maintain implemented solutions (or possibly is able to hire them)
- the solution does not need to be started immediately,
- implemented solution will be used for a long time

Implementation of solutions in Software as a Service (SaaS) and cloud solutions model is supported by the following evidence:

- classes (using implemented software) are sporadic (are executed for a small number of people or a small frequency),
- it is necessary to start solutions quickly,
- organization does not have adequate human resources and does not intend to invest in them,
- competencies required to implement the solutions are rare or are expensive,
- organization prefers to incur predictable, low and staggered expenditure rather than one-off large investments.

In the case where it is difficult to identify the fulfilment of specific conditions, consider the implementation of solutions in models of transition: Infrastructure as a Service (IaaS) or Platform as a Service (PaaS).

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Summary

The author of this chapter noticed that it is necessary to deliver theoretical knowledge about management and also practical knowledge about using IT tools (for business management) in practice, to develop whole management skills. For example student should not learn only about Project Management methodologies, but they should learn how to use IT systems to support project and portfolio management.

The author of this chapter noticed that the level of complexity of IT systems increases, and the qualifications needed for their implementation are getting higher too. The number of systems which are used in business organizations is also increasing. There is a challenge behind organizations providing knowledge, how to provide (with limited resources - money, personnel, competency, computer equipment, etc.) the

trainees with knowledge, how to use most advanced systems and solutions. However, universities do not have extensive IT staffs and budgets, that may take care about the implementation and maintenance of a number of complex and elaborate systems.

The main question was given: how institutions providing knowledge (including universities) can deploy and maintain complex systems used by business organizations to be able to train students in the field of using these systems.

Based on their own, more than 10 years of experience in the implementation of systems supporting project management and analysis of trends in the IT market, the author of this work has identified different possible deployment scenarios. There are: on-premise, Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) and cloud solutions. These studies were focused on two scenarios: on-premise and Software as a Service (SaaS) and cloud solutions.

Comparing this two solutions it is possible to say, that cloud solution are alternative for on-premise installations, and can help to deliver advanced learning platform, that simulate the real work environment. Educational entities can choose on-premise or cloud based scenarios, and intermediate solutions as PaaS and SaaS – as needed. They can help educational institutions with small IT staff, in delivering complex IT systems, needed to start training about using professional and complicated business management systems. Large educational institutions are probably able to implement, configure and maintain on-premise solutions.

Acknowledgements

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CHAPTER 10

Knowledge engineer - more than only technical position. The concept of knowledge engineering education at the Faculty of Management and Economics

Tomasz SITEK *

1. Knowledge - the most valuable asset in XXI century

In 1996 OECD developed report, which is considered as the first study in the field of knowledge-based economy. In a knowledge-based economy, the position of an organization is determined mainly in terms of intangible resources. This is mostly knowledge. Such resources have three essential features which fundamentally distinguish them from material resources (OECD, 1996):

- They can be used simultaneously in many places and do not have to be associated with the execution of a specific task in a specific location (such as a machine),
- They do not depreciate during use; on the contrary, they mostly increase in value; unlike material resources they do not lose capital,
- Material resources can be bought and sold always and everywhere. In contrast, intangible resources take a long time to achieve in an enterprise and its environment. It is difficult to trade with them.

Management of the organization should be strictly dependent on knowledge. Decision-maker should be aware of its properties listed above. Knowledge management in

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organizations at a certain level of maturity should be a natural, structured process (Lundvall, Johnson, 1994). Companies that do so can reach the status of the so-called learning (or intelligent) organization. This concept will be explained deeper in the next chapter. An effective learning means the constant acquisition and processing of knowledge from inside and outside of organization. This can be done in a formal way, basing on dedicated smart tools, in particular - expert systems. During their construction and implementation the significant role is played by person in the position of Knowledge Engineer (Bolc, Borodziewicz, Wójcik, 1991). It seems that the Knowledge Engineer will be the profession with the future. Therefore it is important that universities early enough see the needs of the market and educate graduates able to function in this area.

From the perspective of the Knowledge Engineer's tasks (described in chapter 2) it can be concluded that it is typical technical position. The majority of teaching programs educating the Knowledge Engineers are profiled exactly in such way. The author claims that this is not right approach anymore. Expert systems have always been under intended as technical systems - operating on quantitative data. However, today many of the decisional problems on various levels of management have qualitative nature. The Knowledge Engineers should not be just the coders of knowledge. They must understand the organization and the processes inside. Therefore, in the opinion of the author, they should receive interdisciplinary education.

1.2 Learning organizations – effective knowledge management and decision making

The increasing importance of knowledge for the functioning of an organization at the same time resulted in the increase in formal (and informal) ways of knowledge management. This need is addressed by the process of so-called 'organizational learning'. According to D. Nixon (Zgrzywa-Ziemiak, Kamiński, 2009) this refers to the intentional use of learning at the level of an individual and a group, and the system of continuous transformation of an organization in a direction which will ensure the increased satisfaction of its shareholders (this includes both adaptive and innovative learning). D.R. Schwandt sees organizational learning in a slightly different manner - as a "system of actions, actors, symbols and processes which enable an organization to transform information into valuable knowledge, which in turn increases the long-term adaptability of the organization." (Zgrzywa-Ziemiak, Kamiński, 2009).

All authors agree that organizational learning means an effective knowledge management. Management is nothing more than the constant decision-making. Therefore organizational learning must be seen through the prism of decisions taken at all levels (Sitek, Orłowski, 2011). All decisions and their evaluation should generate new knowledge for the organization. Obviously, the most desired state is the uninterrupted sequence of effective and efficient decisions. However, this does not happen too often.

The main reason is the lack of support in decision-making. This may be serious problem for each decision-maker and the learning organizations as the whole.

1.3 The need of support in decision making process

Organizational learning means that all decisions made in the organization – both individually and collectively – are considered as important. Therefore, the following question can be raised: what determines the fact that a decision is good? When do decisions seem easy, while others are difficult? One of the key factors is the availability of knowledge. Do managers always have enough knowledge? Hardly ever. Usually their only knowledge is a result of their previous experiences. Also some intuition plays a role.

Unfortunately, most of the decisions are taken in not too comfortable conditions. Managers do not have adequate or full knowledge. Potentially the best solution in this situation would be additional, external support –the knowledge and/or experience of the third party person (or organization). However, unfortunately such support hardly ever exists in any formalized, ready-to-use, form. However there is answer to such problems - dedicated tools called 'expert systems' (Zieliński, 2000; Mulawka, 1996).

Decision Support Systems

Nowadays all main processes of the companies are based on some information technologies. There are numerous kinds of IT systems that support the company in various aspects of its functioning. ERP (Enterprise Resource Planning) systems help manage resources. MRP (Material Resource Planning) tools are supposed to support manufacturing processes. CRM (Customer Relationship Management) became synonym to the whole philosophy of building long-term relationships with customers using dedicated IT tools. All of them have one thing in common - they are transactional systems. This means that their main task is to record results of business activities as a data.

The increasing complexity of business reality turned out to be a prerequisite for the creation of tools acting on a more abstract level than simple data processing. Data/information processing (interpretation) sometimes may be not easy and requires time. It is therefore very imperfect support for the decision maker. That is why systems that operate on knowledge were born.

Decision Support System (DSS) originally meant a system whose task was to provide the decision-maker acceptable variants of the actions related to the search for the best decision. Such kind of systems was basing mostly on mathematical models and performed the calculations on different variants of the answer (Negnevitsky, 2005). Expert Systems – as they are called today - are understood as technology able to store and process specialized knowledge on a specific area of human activity and providing advice on problems which cannot be handled by the user.

Thus, each expert system is a substitute for a human expert, able to provide consultancy services in the face of user's problems. The concept of an expert system can be explained from the perspective of its structure (Figure 1).

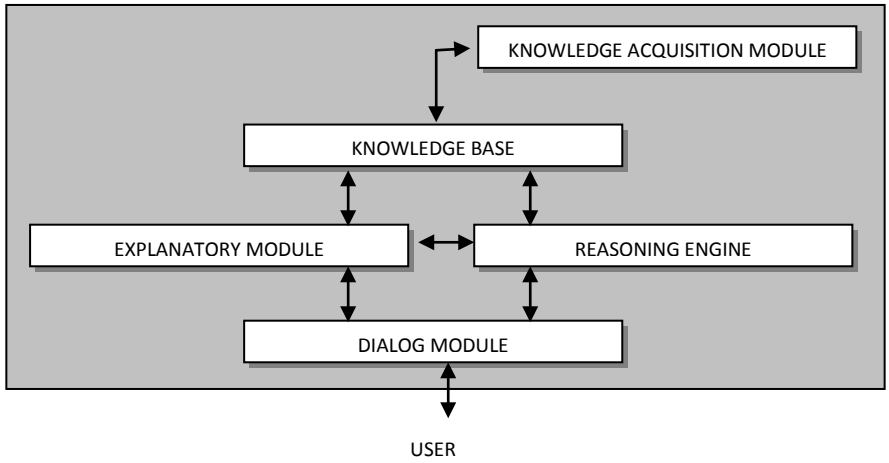

Fig. 1 Architecture of a typical expert system (Mulawka, 1996)

The two most important components of decision-making systems are:

- Knowledge Base - knowledge formalized in the chosen way, either constant or variable (terms, facts constants, definitions, interpretations) and a set of inference rules;
- Reasoning machine (engine) - the algorithm archiving the objective of searching for best solution, making a use of the knowledge stored in the knowledge base.

Typically in this class of IT system there are also other components (shown in figure 1):

- Dialog module - the part of the system responsible for interaction with the user, editing messages, explanations and answers;
- Explanatory module - the module executing search and displaying detailed response to a user query;
- Knowledge acquisition module – implemented artificial intelligence methods and algorithms of automatic learning in order to supplement the knowledge.

Most of the IT systems are usually being built by a team of programmers and analysts, under the direction of Project Manager. Such IT projects are being carried out basing on the selected methodology. They have their scope, budget and schedule.

However, building the expert system is a project that differs from such a scheme. An important difference is that the quality of the expert system is a direct result of the quality of the acquired knowledge base. It also determines the approach to creating

knowledge-based systems. The most important role plays here a person called the Knowledge Engineer.

2. The role of the Knowledge Engineer

2.1 The Knowledge Engineer - key competence

The term "Knowledge Engineer" first appeared in the 1980s in the first wave of commercialization of AI (Artificial Intelligence). Since the beginning, this term was associated exclusively with IT domain (such as more general concept of knowledge engineering). The core competence of the Knowledge Engineer has always been the translation of knowledge from the language, which domain experts speak, to formal record, appropriate to the chosen technology. According to the most of the definitions, the Knowledge Engineer does not need to have domain knowledge. He should have the technical competence, mostly related to technologies (in particular programming languages) appropriate for a given problem.

According to this approach many universities has been designed their educational programs/courses. Their goal has been to educate such kind of specialist. The vast majority of them have been taught at universities / fields / disciplines of computer sciences (informatics). The Knowledge Engineer who has finished the specialty would be skilled computer expert - specialist. This thesis is proven by curricula that are being published by various educational institutions. For example, the AGH (University of Science and Technology, Cracow, Poland) presents the target competencies of the Knowledge Engineer who decides to take advantage of the offer of the university (AGH, 2013):

- Knowledge representation using symbolic methods (classical logic, modal and temporal logic, fuzzy logic, description logic, ontologies, logical reasoning).
- Methods of knowledge processing (automatic inference algorithms, query processing). Knowledge Engineering Languages: Lisp (introduction to the language and apply to the construction of knowledge-based systems), Prologue (basic logic, the concept of language).
- Problems of machine learning: basic concepts, learning under the supervision (learning concepts, induction rules, probabilistic models), reinforcement learning (Markov decision processes, Q-learning, Sarsa)

Another example: according to the website of University of Economics in Katowice (Poland) ‘a computer scientist specializing in Knowledge Engineering is a highly requested specialist in the market.’ (University of Economics in Katowice, 2014). Thus, we cannot disagree with the second part of this theorem – the Knowledge Engineer is a profession with a future. But does is really have to be a computer specialist?

2.2 Technical position or interdisciplinary specialist?

As mentioned earlier, each expert system serves decision support only within a single, well-defined domain. The workload of the Knowledge Engineer within one project is this series of consultations with the experts in the industry. The aim is, of course, codification and implementation of knowledge to the needs of defined group of decision-making problems. And again following question can be raised: are the so-defined tasks need only technical expertise?

For several years of his working on intelligent systems author had a contact with either various domain experts or specialists in the field of knowledge formalization and processing. The result of this cooperation was much experience and observations. The two most important conclusions are:

- We observe rapid development of computer aided software engineering tools (CASE). Therefore mere experience in using the technology ceases to be the most important factor distinguishing the knowledge base designer. CASE tools are simply more efficient. They displace the practices of building software with programming languages from scratch. In other words, the Knowledge Engineer does not need to be highly educated programmer today.
- The problems of the organizations operating in the XXI century are different than in the last decades of the previous century - when the concept of expert systems was born. Decisional problems tend to be more complex. They have the more qualitative than quantitative nature than ever. Besides, more and more decisions are made under conditions of incomplete knowledge, its uncertainty or low precision.

This means that the approach to the process of identification the sources of information, its extraction and encoding must be less "engineering". The more important become so called ‘soft skills’. The success of IT project is depending on the ability to establish interpersonal interaction, empathy or the ability to manage conflict. Therefore, the following thesis can be raised: the evolution of the Knowledge Engineer profession leads to the fact that it should be to some extent a humanist. What's more, it seems reasonable that, the Knowledge Engineers should not a specialists completely detached from the domain in which they run projects. To be effective, they must possess some elementary knowledge of the subject. The Knowledge Engineers should be so much more than just a skilled technician. Today, they must be an interdisciplinary specialist.

An example of such an approach to the education of the Knowledge Engineer is the Department of Management and Economics, Gdansk University of Technology (GUT), which has the ambition to educate, among all, specialists in the field of business analytics. The target profile of the graduate is the mix of technical competencies and soft skills. This is exactly what engineer knowledge needs.

6. Knowledge Engineer from the Faculty of Management and Economics

3.1 Customer and the goal

The idea for the course program should always be the answer to the real needs of the market. Thus, it must be based on the recognition of well-defined clients (students). They are only superficially known and characterized – they are the students of the Faculty of Management and Economics at the Gdansk University of Technology. Studies carried out in this faculty, however, are quite specific, both in the context of the offer of other faculties of the university, as well as compared to the curricula of other faculties/schools of economics.

The Faculty of Management and Economics has always tried to combine engineering knowledge (e.g. in the field of production or commodity sciences, but also the mechanics) with humanistic skills (strong emphasis on economics and management sciences). The graduate has had an opportunity to focus on the specific course of study because of the choice of specialization (and profile diploma). This decision has determined the further arrangement of the curriculum. One of possible tracks has been the management of information technology. The priority has been preparation for future analytical work in IT field. The target profile of the graduate has not taken into account proficiency in programming or setting up IT infrastructure. It was rather supposed to provide a relatively broad knowledge of key modern technologies (methods, tools) used in practice, in the context of management in many aspects. The best illustration is the division of subjects which the curriculum framework consists of:

Specialization Courses – compulsory, focused on the problems of information technology management (including: Computerization Strategies, Management of IT projects),

- Elective Courses – Complementary, divided into two groups: elective subjects of technical profile (including Quality Assessment Systems, Human-computer Communication) and elective subjects of psycho-social profile (including Legal Aspects of Computerization, Ethics of Computer Engineer).
- Other courses related to the specifics of faculty - essentials of management and economics.

The Faculty of Management and Economics at GUT is the most humanistic faculty at the very technical university. Those, who decide to study at the Faculty must be aware that they are going to be interdisciplinary specialists. Such specialist is supposed to be the educated in the various aspect of the organization management supported by information technologies. He will also deepen the knowledge about project management. In such a specific domain, after completion of the course Expert Systems, a graduate of the described specialty will have a chance to become the effective Knowledge Engineer.

3.2 Limitations

In previous chapters it was emphasized that the target of the course does not have to be a person with education (or experience acquired in other ways) related to information technology, in particular, to programming. Indeed, modern tools supporting application design and build (such as mentioned CASE) allow relatively fast execution of typically technical tasks, although they are not intended for the layman.

Students which are going to complete curriculum described in this chapter, should do have a certain expertise. They chose consciously the specialization related to the analysis and management of IT technologies in organizations. Such choice determines participation in the "Expert Systems" course. Unfortunately this is not the rule. There are people whose choice seems to be made randomly, or as a "lesser evil" (alternative specializations have considered less attractive). This group of the students unfortunately demonstrates the limitations of the concept described in this chapter, as their expertise about IT tends to zero. And that can be a problem, because the program of the course (described in the next section) assumes certain essential skills, such as the basics of spreadsheet (MS Excel). Lack of technical competence, which the Faculty of Management and Economics does not provide, seems to be the only but significant limitation. Less significant limiting factor may be the time – one the course of Expert Systems students spend only one hour per week of lecture and two hours of exercises (labs).

3.3 The program

The course program is divided into lectures and laboratory exercises. These are always two parallel paths. With such a vast field of knowledge, such as artificial intelligence and related expert systems, the path of a lecture course is the support for practical actions. It covers more issues and goes beyond the laboratory exercises. The current version of course is as follows:

- Introduction to expert systems - definition of basic concepts, data, information, knowledge, knowledge acquisition, formalization of knowledge, expert systems;
- Decision-making - analysis of information technology support capabilities, quality problems of knowledge, analysis of the costs of bad decisions;
- The concept of using the knowledge-based systems - justification, user needs, practical applications;
- The structure of the expert system - a discussion of the components (knowledge base, reasoning machine, explanatory module user interface)
- Knowledge formalization methods - facts and rules, frames, semantic networks, ontologies;
- Fuzzy logic as a tool to formalize knowledge - the basic concepts of fuzzy logic, linguistic variables, fuzzy sets, membership functions, fuzzy modelling;

- Examples of application of fuzzy logic to formalize knowledge - the processes of blurring and sharpening expertise on IT project management, the use of fuzzy modelling;
- Technologies dedicated to the construction of expert systems - logic programming languages - Prolog, Clips, CASE tools,
- Alternative ways for supporting business problems with intelligent technologies - artificial neural networks, evolutionary algorithms, hybrid systems;
- Development and implementation of expert systems - examples from GUT project: forecasting the level of environmental pollution;
- Construction and implementation of expert systems - examples from GUT projects - decision support for IT project managers;
- Knowledge and experience - the concept of using SOEKs to record decision-making experience.

Although the lecture is important, laboratories are far more interesting (in the opinion of the students) because of emphasis on practical activities, such as:

- Processes of extraction the knowledge from the available business information;
- Identification and resolving problems with the quality of knowledge;
- The acquisition of requirements from the customer;
- Cooperation teamwork in the process of building an expert system;
- Presentation of solutions delivered to the client.

These are just few aspects discussed, but it should be noted that most of them are the tasks that requires not only technical skills. Many of the necessary steps usually require soft skills - such as a presentation or even the ability to conduct business negotiations.

The classes are carried out basing on the well known tool - MS Excel spreadsheet programmed with Visual Basic for Applications (VBA). Earlier attempts to use dedicated solutions for creating rule-based systems were abandoned because of their too much complexity. Author's experiences have shown that learning the tool itself took too much time and distracted attention from more important matters. The result of course is always a project – an application which implements decision-making support in the selected domain. Such tool should always be presented (in fact: sold - it's the faculty where management and economics matters).

It is also worth to add that many students choose to write their thesis about decision support related issues. Some students interested in the subject can get involved to research conducted by employees of the Department. There are several examples of R&D projects in which students performed the role of the Knowledge Engineers:

- Supporting decision concerning the evolution of processes maturity of IT support organizations (Chabik, Orłowski, Sitek, 2010);
- Forecasting the level of environmental pollution;
- Decision support for IT project managers basing on their experience (Ziółkowski, Sitek, 2013).

4. Conclusions

The organizational learning is the series of informally defined good practices of continuous use of the experience of individuals and groups representing the organization. Knowledge engineering supports learning. In times of globalization, the opening borders for business and increasing competition, knowledge management becomes significant for many organizations. They are beginning to understand the significance of acquiring and processing knowledge. The role of the Knowledge Engineers will also be more noticeable then before. For historical reasons knowledge engineering domain was available only for highly specialized technicians. However, it seems that nowadays the knowledge management no longer needs only technical competence. The more often the success of IT projects - including the construction of expert systems - depends on correct dialogue between business and the engineers building required solution. Only someone who can speak to business, understand business processes and has an idea of the problems of management can play major role in IT project. All of this, in order to build the knowledge base of the highest quality. The Knowledge Engineer educated today should be such person.

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Summary

Organizational learning means an effective knowledge management. Management is nothing more than the constant decision-making. Therefore organizational learning must be seen through the prism of decisions taken at all levels. Unfortunately decisions are never taken within comfortable conditions. Decision maker suffers from a lack of any support. There is often a problem with human resources having right skills, sometimes they do not have adequate knowledge, therefore appropriate analysis cannot be done. Dedicated tools become the answer to such problems - the so-called expert systems. The expert systems are the technology able to store and process specialized knowledge on a specific area of human activity. They can be called substitute for a human expert decision-maker, able to provide consultancy as a result of reasoning from knowledge base. The process of building expert systems requires key position – Knowledge Engineer. This is the person who is responsible for extracting facts or rules from domain experts, and must record it a formal way, appropriate to the chosen technology. Therefore the Knowledge Engineer has always been considered as technical position, specialized IT professional. Only technical universities and faculties offered education programs for them. Such approach is still valid, but times have changed. Author claims, according to his experience gained during several projects that nowadays organizations' knowledge management problems are more complex and have different nature than before – they are more qualitative than quantitative. Big number of decisions is being taken basing on uncertain or incomplete knowledge. Hence, the Knowledge Engineer should be today rather interdisciplinary specialist – with some psychology, management or law background than only technician. The chapter describes the concept of educating Knowledge Engineers on Faculty of Management and Economics – the most humanistic faculty at Gdansk University of Technology.

CHAPTER 11

Application of IT tools in Educational Project Dissemination – Example of the INNOCASE Project.

Małgorzata ZIĘBA *

1. Introduction

Every manager of an educational project, no matter whether this project is co-financed with the European Union funds or not, needs to disseminate it as much as possible, using the most efficient and effective ways. With the appearance of the Internet, there is a growing number of ways in which a project might be disseminated.

The basic fact is that dissemination strategy must be carefully selected depending on the beneficiaries of the project. If project beneficiaries are the elderly people, the ways of getting to this target group need to be more traditional, e.g. leaflets or posters. If the target groups are teenagers, they require more modern means of dissemination, e.g. Facebook fanpages.

What is crucial is that dissemination means of an educational project should be diversified and they should allow reaching as many potential beneficiaries as possible. Traditional means that used to be applied in the projects are not always the best choice. More and more often new ways, based on IT tools, are necessary. This chapter presents new IT-based ways of project dissemination in general and their practical use on the example of an educational project – INNOCASE (Transfer of Innovative Case Study Methodology in Business Education), funded with support from the European Commission under the Lifelong Learning Programme and with Polish Ministry funds for Science in 2013-2014 granted for international co-financed project realization.

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2. Selected IT tools for educational project dissemination.

The development of the Internet and applications based on it allows involving many various means of project dissemination. Among these means are:

- project websites;
- placing information on other (not project) websites;
- e-mails sent to the potential beneficiaries;
- electronic newsletters;
- social networking sites, e.g. Facebook, LinkedIn, etc.
- slide repositories, e.g. Slideshare.net
- placing project materials and videos on video sharing tools, e.g. You Tube.

For many educational projects, their websites are launched. This way of communicating the project rationale, target groups, aims, etc. is usually quite efficient and low budget in comparison with its scope and long-lasting effect. This mean of dissemination helps in reaching many potential beneficiaries located in a variety of countries. If the website is in English, its usability and potential scope is greater than when it is in a national language, e.g. Polish. Therefore, websites of educational projects should be in national languages when the project is addressed only to national public, but in other cases, it should be in English either exclusively or additionally.

A good example of placing information on other (not project) websites is entering this information to repositories with projects. For the educational projects co-financed with the European Union funds within the Leonardo da Vinci programme, the ADAM portal is a very good solution. It allows placing project information and results in an open directory that is available free of charge. Thanks to that, all the potentially interested parties might gain information on the project.

Fig. 4. ADAM - projects database.
Source: http://www.adam-europe.eu

Normally, information about the educational project is also placed on the websites of institutions (schools, universities, SMEs, etc.) carrying out the project. This strategy allows making the stakeholders of these institutions aware of the project and the possibilities of taking part in it.

One of simple ways to get to potential project beneficiaries is to send them an e-mail with the content that could potentially interest them. This is a bit challenging as in the era of overwhelming spam messages. Many people might simply delete such a message, without even taking a look at it. Another problem is the database with e-mail addresses of potential beneficiaries – it is not always available and its creation might be too costly. In such a case as above, it is advisable to use the existing channels for getting to the potential beneficiaries. Often project partners posses their own worked out channels of communication. They might be used for the purpose of project dissemination.

A growing role in educational projects dissemination is played by social media. Social media is a collection of online communications channels devoted to community-based input, interaction, content-sharing and collaboration. Among different types of social media are: websites and applications dedicated to forums, microblogging, social networking, social bookmarking, social curation, and wikis (WhatIs.com).

The usage of social media for educational project dissemination might be beneficial for several reasons. As it is stated in the handbook on *Maximising the social media presence of LLP projects*:

Social networking can prove helpful not only for the dissemination of outcomes but also for i) communicating progress on activities, outputs, etc., ii) engaging with stakeholders and key actors, thus making project outcomes more open and pervasive for shared knowledge and iii) maximising impact and reaching target groups more easily due to network effects (http://www.web2llp.eu/).

All the above mentioned benefits of social media make them more and more popular in the dissemination of educational projects.

What is important is that when a manager of a project decides on the usage of social media, he or she needs to remember about a few crucial rules. First of all, it is necessary to communicate with the audience. Second, if social media are to be used, they need to work. They cannot only make a "fake" impression that they exist for the project, while they are not really explored. Third, one needs to attract the potential audience. It can be done for example with some catching news and pictures. Fourth, one needs to make it viral, meaning that people should be eager to promote it among themselves, recommend it to others, etc. The last but not least is to feel the target group. The application of social media should be focused on its needs and preferences. If that is not the case, it will not prove an appropriate distribution channel.

As it was stated above, there are many tools that constitute the social media group. Probably the most wide-spread are social networking sites. Facebook is one of them. After the registration, Facebook users can create a personal profile, add other users and

categorize them as friends, work colleagues, etc., exchange messages, post status updates and photos, and receive notifications when others update their profiles. What is more, users may join interest groups from their workplace, school or college. Facebook had over one billion active users as of September 2012 (Wikipedia on Facebook). LinkedIn is a business-oriented social network service used primarily for professional networking. In 2013 LinkedIn reported more than 250 million users in more than 200 countries (Wikipedia on LinkedIn). LinkedIn groups are popular with educational projects that can gain from the networking potential of LinkedIn to engage participants into group discussions. In such a way, it is possible to do networking across members and to discuss on a given topic (Maximising the social media presence of LLP projects).

As one can easily notice, such an impressive number of users of Facebook or LinkedIn allows getting with messages about the project to a great publicity. Therefore, this channel should not be neglected in educational project dissemination, especially if project beneficiaries are young people who usually use such social services extensively.

Another way of disseminating project content is placing it in slide repositories. Slideshare.net is the world's largest community for sharing presentations and other professional content. This repository makes it possible to upload and share presentations, infographics, documents, videos, PDFs, and webinars. According to the statistics, in 2013, the site had on average 60 million visitors a month and 215 million page views (Slideshare.net). What is positive in case of many such services is that their users might see or even download the presentation for free – it helps in dissemination of freely available product and results elaborated within projects.

Another means of dissemination constitute services where one can place videos, i.e. video sharing tools. The most famous service of such a type is called You Tube. This service allows people to discover, watch and share original videos. This service is a distribution platform for original content and therefore, it is appropriate for videos generated within the educational project as well. Additionally, many other applications or IT solutions are prepared for embedding of videos placed on You Tube. It allows saving disc space, i.e. one does not need to place the video on the server; it can be simply placed on You Tube and only linked on for example e-learning platform or other website.

To conclude, there is a great variety of IT tools that can useful in educational project dissemination. It is up to the manager which of them should be selected and integrated with the dissemination strategy. Definitely it is worth to consider such modern ways of project promotion, as they are powerful and helpful in reaching high numbers of beneficiaries.

3. Basic information on the INNOCASE project*

The main aim of the INNOCASE project is to adjust and transfer the case study methodology prepared in the RePro project to the new context of business education systems in Poland and in other countries taking part in the INNOCASE project. The RePro methodology was designed to support knowledge and understanding in the business environment, as well as to contribute to personal self-development in terms of teamwork, project management, research skills and negotiation. In the INNOCASE project, this methodology is being modified to suit the SMEs environment (Zięba, 2014).

The project is devoted to three target groups. The first one are teachers/trainers/educators dealing with business education. The second one are SMEs owners and managers, who often lack managerial skills and at the same time, do not have time for traditional training. The third and the last group are university graduates willing to start their own company or work in SMEs. For the first group, training in case study methodology is being prepared in order to increase their competences and skills in this field. For the second and for the third group, e-learning case study pack is being prepared.

The rationale of and the background to the project is multiple. Firstly, SMEs are an important driving force of the European economy. At the same time, they often lack skilled workers, who prefer bigger companies with better promotion possibilities. As the research shows, this is a problem for more than one third of all SMEs in the EU (Guide for Training in SMEs, 2009). SMEs are not eager to take part in external training, as they find it expensive, time-consuming and not dedicated to their needs (Management training in SMEs, 2002). All this results in the fact that SMEs carry out little training (Quality in VET in European SMEs, 2010).

The INNOCASE project addresses an important need for improving qualifications of teachers, trainers and educators in the field of case study (CS) methodology applied in business education and dedicated to SMEs. Within the project, the CS methodology is adjusted to the needs of SMEs and thanks to that, the project offers training that fulfils SMEs needs.

4. Dissemination measures in educational project on the example of the INNOCASE.

In the Innocase project, a set of dissemination measures has been applied. As there are three target groups in the project, i.e. educators/trainers, SMEs (small and medium-sized enterprises) managers and owners and university graduates, the dissemination

* This part of the chapter is based on the article: Zięba, M. (2014), Innovative e-learning approach in teaching based on case studies – INNOCASE project, Zeszyty Naukowe Wydziału Elektrotechniki i Automatyki Politechniki Gdańskiej, No. 37/2014.

measures are diversified. All the dissemination measures were established and described in the Valorization Plan of the project. Preparation of such a type of document makes it easier to gain access to all the target groups in the most efficient and effective way.

The Valorisation plan in the Innocase project was aimed at the following dissemination goals:

1. Raising awareness of and providing information of the project results and activities;
2. Ensuring that project results fulfil the needs and expectations of the particular target groups (educators and trainers dealing with business education & SMEs owners/managers & university graduates);
3. Providing sustainability of the project results not only during the project duration, but also after its completion.

The following elements were subjected to dissemination:

1. The background and purpose of the project.
2. Feedback from partners after the realization of particular tasks.
3. Cooperation mechanisms between the partners helping in successful project realization.
4. Model of cooperation between universities and SMEs leading to the better understanding of VET (Vocational Education and Training) needs in this environment.

5. Project results and outcomes.

The main element presenting the project and its products is its website. On the website, there is placed the general information about the project and its results in English and in partners' languages, i.e. in Danish, Czech, Finish and Polish. Project website is a great tool for raising awareness of the project, its background, main aims and results. It also provides the sustainability of the project results – it will be maintained after the lifespan of the project.

Fig. 5. Project website.
Source: Innocase website, available at: innocase.zie.pg.gda.pl

Apart from that, all the partners placed comprehensive information about the project on their websites, making it accessible to the potential target groups. Placing information on the websites of particular partners has definitely increased the dissemination scope.

All the partners have also prepared presentations about the project in their national languages. These presentations were placed on partners' websites and also on the project website. In the presentations, the basic information about the project was placed, i.e. the goal, aim and objectives, partners and the expected results of the project.

Another way of getting to the potential beneficiaries of the INNOCASE project was to place the information about it in the electronic newsletter of the Baltic Management Development Association. This organization currently has 68 members from 23 countries. This Association was established to induce the quality of management development in the Baltic region and beyond through promoting research, offering educational services and networking opportunities for management development institutions and business enterprises (BMDA website). Sending the newsletter with information on the INNOCASE project to such a broad international audience allowed reaching representatives from all the target groups (graduates, SMEs owners/managers, teachers/trainers) from all over the world. The links to the newsletters with information about the INNOCASE conference are as follows:

- http://www.bmda.net/BMDA/news/bmda-monthly-newsletter-vol.-2-issue-10-2013;
- http://www.bmda.net/BMDA/newsletters/BMDA%20Newsletter_Vol.%203%20Isue%201-%202014.pdf

As among the target groups of the INNOCASE project are relatively young people (e.g. university graduates), social media are extensively used for its dissemination. Within the project, 5 Facebook fan pages were created (in various language versions – Polish, Danish, Czech, Finish and English). On these fan pages various news and information about the project are being placed over the lifespan of the project. These fan pages allow communicating the constant progress in project realization. They also make it possible to stay in touch with the project community. The English version of the fan page is placed below.

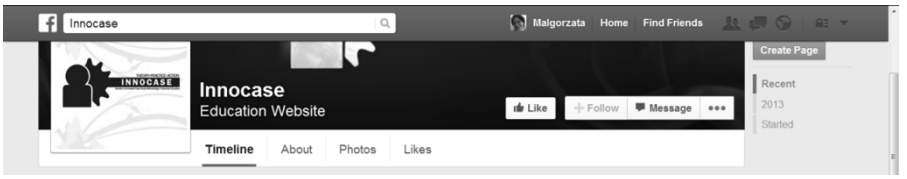

Fig. 6. Facebook fan page of the INNOCASE project (English language version).
Source: https://www.facebook.com/pages/Innocase/493317127382344?ref=profile

Apart from the above-described means of dissemination, also placing project materials and videos on You Tube has been used. On this website, the following videos resulting from the INNOCASE project are placed:

- Video from the dissemination meeting in Horsens, available at: https://www.youtube.com/watch?v=3EuONJwUKaQ
- Manual for the usage of the e-learning case study pack, available at: https://www.youtube.com/watch?v=dPVEZCFQdLI
- Promotional material on one of the project meetings, available at: https://www.youtube.com/watch?v=_a3hvEUpRQ8
- Learning materials, available at: https://www.youtube.com/watch?v=ImQRBGs12Z4 https://www.youtube.com/watch?v=AFPGZHIeQYQ
- Follow-up after the ITBM 2014 Conference in Gdansk, available at: https://www.youtube.com/watch?v=POm5aNhHzdo

Such a variety of videos make it more probable that potential beneficiaries will find them and make themselves acquainted with the project and its results.

6. Conclusions

To sum up, on the example of the INNOCASE project one can notice that there are many potential ways to disseminate project in a modern way. There are abundant possibilities to use the IT tools for project promotion. Some of them are well-know and applied for years (e.g. e-mails or project websites), while others are still a new phenomena requiring further investigation (e.g. social media). It is definitely the truth that any tool needs to be used wisely, with a determined purpose and in response to potential beneficiaries' needs – only then promotion of an educational project might be successful.

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Summary

The chapter presents innovative approaches (based on IT) to educational project dissemination. The appearance of the Internet and various tools based on it allowed using new methods and channels of getting to target groups and project beneficiaries. The chapter describes a great deal of dissemination means based on IT tools that are available to contemporary project manager of an educational project. These tools might be applied for the dissemination of a wide range of educational projects and better access to dissemination addressee. In the chapter, there are also presented the applications of selected IT tools for the purpose of the INNOCASE project dissemination. On this basis, conclusions and suggestions for other educational projects might be drawn.

Abstracts

Chapter 1. Krzysztof REDLARSKI: The use and development of e-learning systems in educational projects

The chapter introduces the problem of usage and development of e-learning systems among Polish universities. Easily accessible internet and IT development led to changes in education. Through the use of IT tools, e-learning has become an increasingly popular form of education. Presently, majority of Polish universities use an e-learning system of their own choosing designed to support the didactic processes. The goal of the chapter is an assessment of the popular e-learning systems used in selected group of universities, overview of their advantages and disadvantages, and pinpointing causes of problems associated with their use. A case study, carried out within the research among the main educational projects participants, took into consideration the opinions of users of different e-learning systems. Solutions suggested within the chapter should primarily be useful to decision-makers responsible for development and implementation of new e-learning systems among universities. The conclusions might prove helpful in taking the right decision to effectively use the new IT tools. The chapter also highlights the existing opportunities and obstacles of e-learning system development, as their main goal is to shift the form and increase the attractiveness of lectures, and, at the same time, increase the effectiveness of the learning process.

Keywords: Project management, IT project, educational project, e-learning system
JEL Codes: I20, I25

Chapter 2. Beata BASIŃSKA, Izabela WICIAK: The online application and e-learning in the competence-based management in public administration organizations

Purpose. The integration of effective management of work-related processes and utilization of human resources potential leads to the development of organization. This problem is particularly important in organizations of public administration, where the results of work do not always conform to expected standards. The purpose of this chapter was to examine how the principles of competences-based management can be introduced to enhance organization's effectiveness in human resources management.
Design. A model of assessment and development of competences-based management, embracing an online application and e-learning has been designed. The project refers to managers of the Polish police.
Results. The project involved three groups of activities. Firstly, a model of competences-based management was developed along with instruments supporting their assessment (guides for competence-based interviews, a 360 degree feedback, sessions for Assessment Centres and Development Centres, psychometric questionnaires for testing competences of managers). Secondly, online application for the system assessment and development of managerial competencies, were designed, an online platform and instruments were implemented and their testing were conducted. Thirdly, questionnaires and training modules for workshops were developed and implemented on an e-learning platform.
Discussion. The introduction of a coherent system of competences-based management, integrated with the online application may lead to the development of the organization. The expected barriers and added values have been discussed.

Originality/Values. The model of competences-based management using the online platform integrates the human resources management with the results of work and the accomplishment of key processes.

Keywords: competence-based management, e-learning, effectiveness, human resources, managerial competences, online application.
JEL Codes: A290, O310

Chapter 3. Igor GARNIK: Multimedia in teaching economics and management in higher education

Nowadays, the use of multimedia teaching materials at universities makes a standard practice. However their saturation is still quite low comparing to the expectations of students - the main consumers of the information contained therein. This chapter will present the results of research conducted among students of Management and Engineering Management carried at the Technical University of Gdańsk. Some students of Computer Science at Polish-Japanese Institute of Information Technology in Gdańsk were interviewed as well. The author pays particular attention to the use of multimedia in the lectures of economics and management.

Keywords: Graduate Teaching of Economics, Introductory Material, Data: Tables and Charts
JEL Codes: A230, Y200, Y100

Chapter 4. Marcin KOŁACZ, Izabela RICHTER: Development of economic education through mobile technology

The aim of the chapter is to present new technology capabilities to increase effectiveness and efficiency of education basing on knowledge-based economies (KBE) as those which are directly based on the production, distribution and use of knowledge and information. What is especially crucial for the authors is to proof that connecting usage of the knowledge and IT tools let develop Polish education system. Due to OECD experts what is crucial is permanent education as in KBE only permanent development of knowledge allow to reach success. Moreover, a new model of education should prepare students for professional life in which learning by doing and interacting with others are becoming increasingly important. The solution for the contemporary education system is using mobile technology in learning process.

Keywords: knowledge and information, Polish education system development, mobile technology in economic education, Economic Education ICT tools
JEL Codes: A210, A220

Chapter 5. Marcin SIKORSKI: Interactive Prototypes in Teaching User-Centred Design and Business Process Modelling

This chapter describes experiences gathered during the use of interactive prototyping in two areas: design of user interfaces for a touch screen information kiosk and interactive prototyping of business processes. Prototyping is promoted here as a technique useful for both visualizing design concepts and for stimulating communication within relevant teams.

Developing interactive prototypes of use interfaces is discussed here as a technique with several major benefits: it useful for visualizing design concepts, for usability testing and also for identifying necessary improvements of a specific system. It offers students' an excellent opportunity to observe their own design "in action", what gives instant feedback on user-perceived quality of the system, but first of all it stimulates customer-centred thinking being an essential skill of a prospective IT project manager.
Interactive prototyping of business processes was evaluated in a small-scale experiment with the use of a Metasonic Touch table, which allows for the teamwork in analysis and modelling. Outcomes of this experiment were twofold: advantages point out collaborative learning, knowledge transfer among participants, converting tacit knowledge into explicit knowledge, sharing knowledge and deeper understanding the process. In turn, disadvantages show that the touchscreen device itself draws too much attention from novice users, thus being suitable rather for experienced business analysts than as educational tool for university students.

Keywords: prototyping, usability, User-Centred Design, S-BPM modelling
JEL codes: A22, A23, A29

Chapter 6. Marcin SIKORSKI, Rafał MUNIAK: Nomadic Learning: Is It Delivering on Its Promise? The Tale of Two Projects

This chapter discusses the outcomes of two projects related to introducing mobile learning environments in the Polish-Japanese Institute of Information Technology PJWSTK in Warsaw, Poland. Both projects were based on the concept of "nomadic learning", where a student is a "digital nomad", equipped with mobile device able to play educational content to be "consumed" in any place also out-of-the-class, wherever internet access is, in many short episodes across the student's day. Both projects were aimed not only to expand the PJWSTK university infrastructure towards introducing nomadic learning as a new teaching mode, but also were aimed to invoke changes in teaching methodology for both learners and teachers. Experiences from these two projects have been briefly discussed and supplemented with conclusions and guidelines possibly interesting also for other academic institutions. This chapter is also raising questions about implementing nomadic learning concept in practice as well as about factors affecting its efficiency in real settings. This chapter concludes that more research attention is needed on understanding the mechanism of adoption of m-learning systems in local settings of a specific educational institution.

Keywords: m-learning, nomadic learning, puzzle-based learning, e-learning
JEL codes: A22, A23, A29

Chapter 7. Piotr OLEKSIAK: Teaching management skills to software development teams through the lean start-up methodology

In order for development teams to understand the impact of software development on value delivery it is important that all team members, including software engineers, possess adequate management skills which not always have been acquired during university education. The lean start-up methodology techniques enable new ventures to test hypothesis, gather customer feedback and create a minimum viable product. The obtained information is employed in order to create products that are valuable to the customers, and to restrain from implementing features that are not sought for by the clients. The lean start-up methodology is currently taught in numerous business schools and at software development events such as the Startup Weekend. This

chapter explores how the lean start-up could be used to improve customer satisfaction oriented software product development skills, incorporating not only software programming but also such activities as planning, design, testing, deployment and evaluation. The techniques of the methodology and it's teaching process are analyzed for their influence on decision making. As a result, in order to enhance value-added, innovation-based services, a novel method for teaching management skills to software development teams is proposed.

Keywords: Lean Start-up, Start-up Weekend
JEL Codes: M150, A290

Chapter 8. Artur ZIÓŁKOWSKI, Kamil ZIÓŁKOWSKI: Developing competences of IT project managers using simulation games

Project Management is a domain in which methodological approach is developing very rapidly. Project managers are required to present knowledge of the various methods of project management and apply them to the management of specific projects. It means that project managers must constantly develop their competence, mainly based on good practices from different formal methods of project management. The purpose of this chapter is to demonstrate the possibilities of education of project managers through the use of simulation games. The chapter presents some good practices related to the development of managerial skills project managers using simulation games. Therefore, on the beginning of the chapter, author presents some examples of simulation games related to popular methods of project management. One of the simulations concerns the classical approach - RUP, second relates to the agile approach. The second part of the chapter includes a set of competencies of project managers and then shows how these competencies can be enhanced by participation in such simulation games. At the end author presents a set of observations and experiences based on few project simulations carried on over several years.

Keywords: IT project management, project simulation, RUP simulation
JEL codes: D89, D83, O22

Chapter 9. Sebastian WILCZEWSKI: Cloud solutions as a platform for building advanced learning platform, that simulate the real work environment for project managers

Improving skills of managers and executives require, that during the transfer of knowledge (in different ways: during studies, trainings, workshops and other forms of education) it is necessary to use tools and solutions that are (or will be) used in real world environments, where people being educated are working or will work. Cloud solutions allow educational entities (universities, training companies, trainers, etc.) to provide advanced IT solutions, which reflect actual or future work environment of trained managers, regardless of the level of complexity of the environment. It is alternative for on-premise installation. The purpose of this chapter, is to analyze the capabilities of cloud solutions, their suitability for building workshop environment (reflecting real, business IT environments), and the ability to use these solutions in distributed environments (geographically spread and international groups). It will be made on example of two cloud services: Project Online and Office 365, which could provide a platform for build workshop to develop competencies related to the management of projects and programs for future project, program and portfolio managers.

Keywords: Project Management, Cloud Computing, Software as a Service, IT systems, learning platform
JEL Codes: M15, O32

Chapter 10. Tomasz SITEK: Knowledge engineer – more than only technical position. The concept of knowledge engineering education on Faculty of Management and Economics

Organizational learning means an effective knowledge management. Management is nothing more than the constant decision-making. Therefore organizational learning must be seen through the prism of decisions taken at all levels. Unfortunately decisions are never taken within comfortable conditions. Decision maker suffers from a lack of any support. There is often a problem with human resources having right skills, sometimes they do not have adequate knowledge, therefore appropriate analysis cannot be done. Dedicated tools become the answer to such problems - the so-called expert systems. The expert systems are the technology able to store and process specialized knowledge on a specific area of human activity. They can be called substitute for a human expert decision-maker, able to provide consultancy as a result of reasoning from knowledge base. The process of building expert systems requires key position – Knowledge Engineer. This is the person who is responsible for extracting facts or rules from domain experts, and must record it a formal way, appropriate to the chosen technology. Therefore the Knowledge Engineer has always been considered as technical position, specialized IT professional. Only technical universities and faculties offered education programs for them. Such approach is still valid, but times have changed. Author claims, according to his experience gained during several projects, that nowadays organizations' knowledge management problems are more complex and have different nature than before – they are more qualitive than quantitive. Big number of decisions is being taken basing on uncertain or incomplete knowledge. Hence, the Knowledge Engineer should be today rather interdisciplinary specialist – with some psychology, management or law background than only technician. The chapter describes the concept of educating Knowledge Engineers on Faculty of Management and Economics – the most humanistic faculty at Gdansk University of Technology.

Keywords: learning organization, Knowledge Engineering, decision support, expert systems
JEL Codes: D83, O22

Chapter 11. Małgorzata ZIĘBA: Application of IT tools in Educational Project Dissemination – Example of the INNOCASE Project.

The chapter presents innovative approaches (based on IT) to educational project dissemination. The appearance of the Internet and various tools based on it allowed using new methods and channels of getting to target groups and project beneficiaries. The chapter describes a great deal of dissemination means based on IT tools that are available to contemporary project manager of an educational project. These tools might be applied for the dissemination of a wide range of educational projects and better access to dissemination addressee. In the chapter, there are also presented the applications of selected IT tools for the purpose of the INNOCASE project dissemination. On this basis, conclusions and suggestions for other educational projects might be drawn.

JEL Codes: Not applicable

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