

## **PROJECT AND ANALYSIS OF SOLUTIONS APPLIED IN E-LEARNING SYSTEMS**

DARIUSZ STRZĘCIWILK<sup>a)</sup>, RAFIK NAFKHA<sup>b)</sup>, PIOTR SIERANT<sup>a)</sup>

<sup>a)</sup>*Department of Applied Informatics, Warsaw University of Life Sciences (SGGW)*

<sup>b)</sup>*Department of Informatics, Warsaw University of Life Sciences (SGGW)*

The article presents attempts to identify the needs and problems of modern e-learning and designed a solution that meets the needs of the recipients of e-learning and e-learning content providers. On the basis of this analysis, it was found that the market lacks the e-learning platform that meets all the needs and requirements in remote education. E-learning systems are very poor functionally, and tools for achieving the objectives, such as content creation, content distribution, management learning, and synchronous online meetings appear as separate applications that do not necessarily work well together. Most often each of them must be used separately that extends the preparation of training materials, and is a burden in the administration and supervision of the training course. On the basis of the analysis of remote training needs of recipients and creators of content proposed solution supporting distance learning. On the basis of the analysis of literature and research of user behavior designed and developed an integrated e-learning platform that meets the expectations of the users. The system has successfully motivating tool to complete training and does not require expensive implementation. The main objective of the proposed system was to eliminate the disadvantages observed in other systems. It was found that the human factor impeding the effective acquisition of knowledge as lack of motivation for self-study and the lack of contact with the teacher. In order to minimize the impact of these factors on the educational goals proposed solutions such as elements of competition and extensive virtual classrooms.

Keywords: e-learning system, training course, e-learning platform

## 1. Introduction

The model of operation of modern organizations is subject to constant, dynamic change that enforces the requirements of the market and economic conditions, demographics, and more. An important factor in the functioning of companies and organizations are also new technologies. IT systems contributed to the way you work, running a business and performing its statutory organization. Content Management Systems ERP (Enterprise Resource Planning) [1], systems of customer relationship management CRM (Customer Relationship Management) offer new opportunities to improve operational efficiency and management of the organization [2-4]. The consequences of the introduction of new information technologies create pressure for changes in the functioning of companies, their organizational structures and have a significant impact also on the training process of the company. An increasingly important role in today's organizations also play e-learning systems [5]. E-learning contributes to a more efficient use of resources and communication tools. Users of the electronic courses learn to communicate effectively in the network and are able to work effectively in virtual task forces. The most popular and the most effective method used in educational portals for sharing knowledge and learning process management are e-learning platform. This platform is an advanced learning system designed for both self-study and under the supervision of a teacher. Type systems LMS (Learning Management System) in recent years have dominated the remote education (Internet-based education) [6]. LMS-based systems sometimes occur as part of ERP systems. E-learning can be useful both in the process of skills training hard and soft. E-learning systems allow you to enrich knowledge and are a source of data that can be used at any time. The level of capabilities of such systems and tools is similar to the requirements traditional courses. For the a virtual form of learning is supported mainly savings, as well as the opportunity to present multimedia content. In most cases barrier of distance learning is the lack of knowledge of the real possibilities of such tools, and lack of confidence in them. However well prepared and guided e-learning courses using the latest capabilities can not only compete with traditional training, but in many cases, they may be more effective. The e-learning has not only many advantages, but also disadvantages. Good understanding and definition of defects allows to countering irregularities during design and implementation phase of distance learning processes. Allison Rossett [7] gathered the advantages and disadvantages of teaching in e-learning model. Typical pros and cons of e-learning courses are shown in Table 1.

**Table 1.** Advantages and disadvantages of e-learning

Advantages	Disadvantages
Reducing the cost of the trainings	Additional investment
Standards of knowledge	The high cost of development and maintenance of training
Convenience of training implementation, context, multithreading and individualized training	The atomization of knowledge could lose the context and the gaps of knowledge
The possibility of a good supplement to other training	Lack of reliability in the process of remote communication, the ability to impersonate for an expert
The centralization of the educational process	Training is superficial because it focuses on solving the problem rather than on in-depth knowledge
The learning environment free from sanctions	Reproducible quality of training (if training was bad-prepared, this is bad quality)
Reduction employee turnover	The negative impact on the culture of the organization after replacing traditional training courses of e-learning
The ease of modify the content and its immediate distribution	The necessity of involving large resources during the implementation of e-learning training, implementation ceases to be carried out solely by the training department

The implementation of the e learning in an organization, whatever its type, must take into account such elements as:

- **Technology** - software used to create e-learning content, as well as infrastructure through which content will be distributed
- **Content** - available in an electronic teaching materials, tests and exercises, videos, animations, simulations, educational games, webcasts, and more.
- **Communication** - a means of communicating participants trainers, manner and form provide information on how to conduct training
- **People** - the recipients of training have experience in the use of learning, territorial dispersion participants, competence of participants
- **Context** - the scale of training and the conditions in which is implemented e-learning training, the duration, the scope and the characteristics of the target group
- **Behaviours** - associated with perception and understanding of the training by the participants and their surroundings.

The literature provides several different typologies of remote training [8, 9]. Trainings can be divided due to the form of transmission of educational content, training and development model of the type of training content. Division with

regard to form of communication asynchronous training stands that allow you to learn at your own pace, form the limits to self-education and training Synchronous where participants use the materials at their own pace, but communicate with the coach at a specific time. Such communication can provide, eg. virtual class. When the division due to model development training courses distinguish ready, personalized training and dedicated training. The division of training due to the type of content refers to what skills acquire the trainee. Hard training concern the knowledge and skills in areas related to their work and soft skills training relate personal skills and personal development of the trainee. It is worth mentioning that the structure has been standardized e-learning training [10]. It was developed a number of standards and guidelines for the development of training content. The standards define the principles of construction of educational materials, their operation and use in the teaching process. One of the most prominent are the ECC standard (E-learning Courseware Certification) [11] concerning the structure of the content of the training and SCORM standards (*Sharable Content Object Reference Model*) [12] and also AICC (*Aviation Industry Computer-Based Training Committee*) [13]. They are associated with technical issues. Standard ECC is distributed by ASTD E-learning Institute and is designed for asynchronous courses based on the web and multimedia and formulates criteria for navigation, location and response messages, links, assistance and legibility and quality of the published text. SCORM standard defines, based on network technology, content aggregation model training (Content Aggregation Model) and runtime environment (Run-Time Environment).

The aim of this study was to develop a system that supports distance learning, which supports solutions to meet the needs of both the recipients and suppliers of e-learning and e-learning content. When designing the system attempts to eliminate the disadvantages noted in other systems. The main aim was to build such an application that is user friendly and content creation in time is more effective than in other systems, while maintaining maximum functionality and complexity of the system. In order to minimize the impact of human factors on the educational goals proposed solutions such as elements of competition [14] and expanded virtual classrooms.

## **2. Training management system**

The CMS system is a computer system that automates the management, administration, tracking and reporting of all activities related to education and training in one or more institutions. LMS systems are the basis for the transfer of knowledge in corporations and allow you to organize a training plan, deliver and manage them. Training can be conducted with the support of the coach or not, they may be assisted synchronous meetings in communities to work together online, eg.

In a virtual classroom. The system allows to evaluate and report their progress of the divided students, group, business lines. Invigilators of training enables clear insight into the educational activity that involves students and staff of the organization. At the same time they allow you to manage the competences and skills and detect gaps in knowledge in areas taught and complement these gaps. The basic tasks of LMS are primarily functions:

- **Management** - allows you to design schedules classes and courses, to build a directory of available resources, import and publish courses trainees, resource training management, management fees for courses,
- **Supporting the process of remote training** - allows you to share training content to a wide audience to diffuse territorial area, yet allow for easy communication in a consistent learning environment
- **Tracking the process of learning** - functions allow you to collect data on the educational process, the actions of trainers, collecting reports of time spent on learning, monitoring the behavior of students while learning, record the costs of the learning process
- **Reporting** - functions to generate reports on learning outcomes, student satisfaction, their behavior in the educational process and other reports of an administrative

An extension of LMS class systems are the systems LCMS (Learning Content Management Systems) [15], in which the basic functions are supplemented with tools for creating training content. LCMS helps you create, reuse, localize into multiple languages, deliver, manage, and improve the content of training courses. The content usually is managed in a centralized archive in the form of small, self-describing, identified elements or as training units. The LCMS is able to provide the customer with a personalized of training unit training to meet a single task or provide a larger elements of the course, as defined by the LMS. In advanced systems are controlled LCSM student interaction with the objects of the course and based on this information provides the student a personalized study path. LC MS provides invigilators transparent and valuable reports that in the future may also be used to improve training facilities. Some of the LCMS systems allow cooperation and exchange of knowledge with regard to training facilities between students and teachers. While in most LMS realized tasks are similar, LCMS systems may vary significantly. Tools for creating content can be integrated into the system or can be external programs. A supplementary element of LMS systems can be the type of LCS (Live Communications Systems) [16]. These systems are used to support synchronous e-learning. To the requirements of the LCS systems must support video conferencing and VoIP, which allows you to stream video and voice over the Internet network. Using a virtual whiteboard is possible to view what a lecturer wrote. A useful feature is also shared teacher's computer desktop. Transmitted live lessons are usually archived by LCS as a training facility. LCS systems can be

interchangeably used with systems VCS (Virtual Classroom System) [17, 18]. These solutions enable the management and operation of distance learning in synchronous mode "live". VCS provides several possibilities for collaboration, communication and distribution of knowledge with immediate feedback. High-quality solutions enable this class, among others:

- carrying out any kind of training activity in synchronous mode using a virtual whiteboard or screen sharing.
- application sharing, audio and video communication, chat, etc,
- synchronous learning process management, build training materials for use in training "live".

Comparison between systems classes LMS, LCMS and LCS are shown in Table 2.

**Table 2.** Comparison of e-learning systems

System	LMS	LCMS	LCS
Dimension	People	Knowledge	Communication
The main function	Management of training and competence building	Management of training materials	Management of communication and cooperation online
Ability to manage the process of training	Full includes not only of training remote, but also a stationary	Very limited, covering only courses built with the system	Very limited - covering only the learning process synchronous
The possibility of building courses	Very limited, usually only simple forms of exercises	Full: the content repository facilities management, version management features and facilities management group work	Very limited - covering only the learning process synchronous
The ability to interact	Very limited (usually chat, forum)	Very limited (usually chat, forum)	Full of opportunities to interact online cooperation and communication

E-learning currently facing several important issues that were identified during the consultation with the recipients of e-learning as well as with companies and organizations implementing learning. These problems were also confirmed by the literature and reports about e- learning [19]. The problems relate to both e-learning content providers and their customers. They reduce the effectiveness of achieving the objectives of both educational and commercial.

We identified the following problems:

- Lower motivation to learn,
- Time-consuming process of starting up training of e-learning,
- No contact with the teacher / mentor.

The last problem results from the specific forms of distance learning and the first two problems are the result of several factors. In the case of smaller motivation such factors are flexibility of time and pace of learning - on the one hand, this is one of the main advantages of e-learning, but the recipient of the training must take care of the realization of the material in good own pace. E-learning system which is not user friendly may discourage to use it. Long process of starting up training of learning affects:

- E-learning software implementation process, which often is complicated and expensive,
- The process of creating content is a less effective laborious.

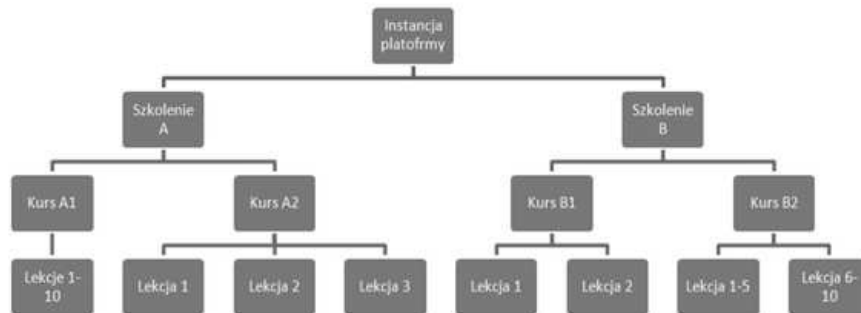
Based on the above analysis the e-learning management system has been made.

### 3. The project of integrated system of e-learning

The main idea was to create a platform for e-learning as a comprehensive computer system used to conduct and manage e-learning trainings integrated with external services. The application was made as an application type client - server which includes: database, application server and web services WSDL definitions. The system design was made using the Flex platform. The use of e-learning platform designed the Flex SDK allowed the execution of rich functionality and tools that make at other technologies would lead to an ineffective effort. In addition, the Flex SDK includes support for building applications for mobile devices. For its portrayal content of the design platform is responsible Flash Player now the world's most popular platform for playing multimedia content. The project application was preceded by studies of user needs in terms of functionality and in terms of usability. On the basis of a general presumption of what was to create an integrated system of e-learning brought together some functionality useful in remote teaching. Our system includes such modules as

- **LMS** - Management of groups of students, teachers and staff management, customer management, management training, providing training, reporting of learning outcomes.
- **The Wizard of training** - the slides management, media library, testing module, multimedia tools, effects and settings tools.
- **Virtual classrooms** - a meeting place for students.
- **Integration of external services using the API service provider** - search videos YouTube, search images from the image bank.
- **A tool for planning activities in the virtual classroom.**

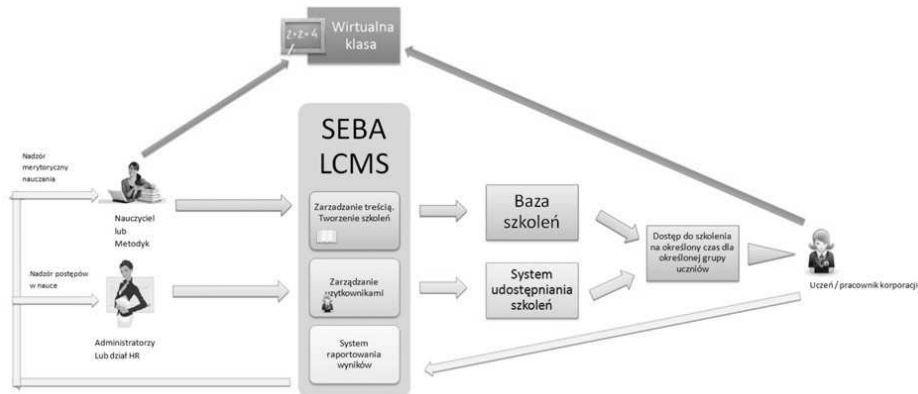
Training of e learning within the designed platform was divided according to the diagram (Fig. 1). The course is acceptable to create any number of training courses. Training can consist of any number of courses (modules) within which you can create any number of lessons.



**Figure 1.** Structure of the training

The lesson is a unit of knowledge to assimilate and can consist of any number of screens training. Each screen contains objects that serve the transfer of knowledge. Such objects are: text, images, sounds, tests, quizzes, games, comics and more. Objects on the screen may occur singly and may also be any number of them on a single screen. In the system separated tasks that can be performed by different user groups (administrator, student, teacher). Users after log are redirected to the appropriate view depending on the role played in the system. The developed system consists of multiple modules which will eventually allow you to achieve the desired educational goal. The flow of information in the system is illustrated in Figure 2. This is the proposed flow of information within the organization conducting the training or e-learning courses. In addition, the system includes a closed environment in which organizations or school and university teach, where they are known in advance the person to which the training is reached. This way you can organize trainings called closed. Using the module included in the system of retail sales training organizations, academic institutions, or independent developers can distribute content created courses and training in a different manner shown in the diagram (Figure 2). In such a model of content distribution person or organization has a predetermined planned list of people participating in the training. This way you can organize open training courses, which enroll any interested individual. Such training can be free or paid for. Payments for training the user performs directly in the system using the integrated payment system. In the event of such a distribution model training, a user must visit a portal (web site) on which there will be a list of possibilities to acquire training, select the training of interested to him and make his purchase.





**Figure 2.** The flow of information in the system

Designed in the system editor lesson allows you to build attractive visually and content-rich lessons and training. The functionality of the editor is divisible into several areas. To perform the tasks of a given area serves a variety of tools and controls that allow you to achieve the desired effect. There are different types of exercises and tests, for example drag and drop tests, filling gaps in the test, the traditional multiple choice and single choice. Created educational content can gain a new dimension with the Wizard comics and stories. To illustrate the content of the lesson, you can add video from prepared file. You can also use the system's built-in search videos from YouTube, video or audio record audio directly from webcam and microphone. Creating educational content can be used also available in the wizard animations and effects. Through its dynamics are more attractive presentation of catching attention and making that their content will be rapidly assimilated and stored by the user of training. As the content of the training can be placed on the stage of pre-prepared presentations in Microsoft PowerPoint, and PDF files or MS Word documents. You can also import training content created in other programs and available in SWF format. For lector's base was used IVONA [20]. With this solution all the training content can be automatically read by the computer. In addition, in the lessons can be also put a recording of the prior prepared mp3 files. In addition, you can record the contents of each track a lecturer straight from the microphone. Lesson editor interface consists of 5 major components which are shown in Figure 3. Using this interface, you can prepare a complete lesson training without leaving the application. All tools and options are placed in practical locations, and also are described by means of called tooltips. The lesson editor has also been included media library that organizes all the files and multimedia placed under training. It allows you to reuse the same files and makes it easier to browse files stored in the training.



**Figure 3.** Interface of lesson editor

Working with the system consists of several stages. The most important are: the introduction of user: employee, teacher, student and the introduction of training content. That the training was complete in addition to creating training wizard. You should design a training structure and create a system of appropriate modules divided into lessons.

#### 4. Conclusion

When reviewing the e-learning solutions available on the market, it turned out that there is a need for a modern e-learning system which integrates a lot of tools. After analysis of e-learning solutions it can be concluded that rarely the solutions are attractive for consumers and content providers. Lack of consolidation services and e-learning software can lead to the belief that distance learning is costly and complicated and open source tools are too poor functionally and difficult to handle. Existing solutions LMS type not usually meet all the training needs of both companies and educational entities. Such systems should be introduced that content to be created by means of external tools. Creating content in open source systems is tedious and time-consuming. The tools are not enough insights and are not ergonomic. In the designed system the emphasis is placed on comfort and speed of content creation. The proposed system comprehensively meets the needs of remote education, and effectively addresses emerging issues. Designed platform can be expanded and adapted to the expectations of wider audience by adding new functionality. It should be noted that the fundamental assumption of the design was the intuitiveness and simplicity in the use of the platform. Adding new functions in the system should be preceded by research utilities so as to be consistent with the current assumptions and would not introduce user confusion.

## REFERENCES

- [1] Nafkha, R., Strzęciwilk D., (2014) "*Risk assessment for ERP system implementation*" Information Systems in Management 3, 182-192.
- [2] Payne, Adrian, and Pennie Frow (2005) "*A strategic framework for customer relationship management.*" Journal of marketing 69.4, 167-176.
- [3] Chen, Injazz J., and Karen Popovich (2003) "*Understanding customer relationship management (CRM) People, process and technology.*" Business process management journal 9.5, 672-688.
- [4] Gustafsson, Anders, Michael D. Johnson, and Inger Roos (2005) "The effects of customer satisfaction, relationship commitment dimensions, and triggers on customer retention." Journal of marketing 69.4, 210-218.
- [5] Oztekin, Asil, Zhenyu James Kong, and Ozgur Uysal (2010) "*UseLearn: A novel checklist and usability evaluation method for eLearning systems by criticality metric analysis.*" International Journal of Industrial Ergonomics 40.4, 455-469.
- [6] Dagger, Declan, et al. (2007) "Service-oriented e-learning platforms: From monolithic systems to flexible services." Internet Computing, IEEE 11.3, 28-35.
- [7] Rossett, Allison (2002) The ASTD e-learning handbook: Best practices, strategies, and case studies for an emerging field. McGraw-Hill Trade.
- [8] Zając, Maria (2004) "*Dydaktyczne aspekty tworzenia kursów online.*" Metody, formy i programy kształcenia, 10.
- [9] Charucka, Olga (2013) "*Działalność innowacyjna przedsiębiorstwa w sektorze usług.*" Kwartalnik Naukowy Uczelni Vistula 3 (37), 70-86.
- [10] Hyla, Marek (2007) *Przewodnik po e-learningu*. Wolters Kluwer Polska.
- [11] Sanders, Ethan S. (2003) *E-learning courseware certification standards*. American Society for Training and Development.
- [12] Friesen, Norm (2004) "*Three objections to learning objects and e-learning standards.*" Online education using learning objects, 59-70.
- [13] <http://www.aicc.org/>
- [14] Tkaczyk, P. Grywalizacja (2012) Jak zastosować mechanizmy gier w działaniach marketingowych, Helion, Gliwice.
- [15] Liu, Xiaofei, Abdulmotaleb El Saddik, and Nicolas D. Georganas, (2003) "An implementable architecture of an e-learning system." Electrical and Computer Engineering, 2003. IEEE CCECE 2003, vol. 2 IEEE, 717-720.
- [16] DeNicola, Cosmo T., et al. (2001), "*System and method for live interactive distance learning.*" U.S. Patent No. 6,288,753. 11 Sep.
- [17] Kumar, Rajnish, and Swati Shahi (2013) "*Virtual Classroom System*", International Journal of Engineering Trends and Technology, (IJETT)-Vol. 4 issue 4 April, 1231-1236.

- [18] P. Sierant, „Platforma szkoleniowa online do nauki języka angielskiego”, Pol. Świętokrzyska, Kielce 2009.
- [19] Raport e-learning Trends – Raport Summer 2011 – I edycja lipiec 2011, *Interaktywny Instytut Badań Rynkowych*, Warszawa 2011.
- [20] [www.ivona.com](http://www.ivona.com)