

E-learning solution - large scale implementation

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Abstract— After years of gathered experiences related to learning management systems we realize that integration of business intelligence and knowledge is one of the main reasons of success. Many LMS are let's say open minded sources of information in some cases partly organized. Not so many of them are managing students into groups, taking care of attendance, notifying students or creating social community. Giving students the opportunity to access digital library sources shows us better usage and global successes of LMS. With implementation of these technologies and implementation of business intelligence we are trying to build instructive and successful learning management system ready. As an prove of proper implementation we would like to present you our achievement on large scale education project - Modernization of education process. We are successfully mastering specific requirements and custom education handling coming as necessary needs from our customers.

I. INTRODUCTION

Integration of business processes and learning management systems is showing us new direction and heading of LMS. Most of the learning systems have some sort of management mainly related to learning content. There are not too many complex learning management systems which are caring about student management documentation generation and other business processes. In my case research is pointing to business case implementation and knowledge related learning content. Managing students into groups, taking care of documentation such as student attendance, learned themes, books acceptance and others is strongly related to business scenarios. Lector or teacher doesn't have to create any type of documentation to prove any sort of actions. All documents are coming from LMS. He or she just needs to print themes and sign it. Verification is confirmed by database information, copies of documents protected by server.

II. ANALYSIS

Learning management Systems

Learning management systems are information systems used for on-line and independent education. LMS are distributed in following areas :

- General LMS— are mostly used to cover education in many individual and autonomous can cover education in many fields
- Problem-oriented – are supporting tools and functionality for education of a particular subject. Generally study of other subject can be problematic.
- Combination of both general and problem-oriented [4].

Problems in this distribution of LMS are eliminated with knowledge-based principles, which transforms standard learning management systems into knowledge based LMS.

Development of knowledge based LMS (KBLMS)

Development of KBLMS consists of several steps:

First of all analysis of teaching materials and courses are at the very begging of whole process. This step can be provided in developed system. This is followed by selection of the most appropriate intelligent supporting technology. For example, LMS systems for teaching programming languages must have built-in multiple sources of documents and syntactic analyzers for a selected language and components for analysis of student results.

Project of architecture of new LMS system is certainly the next step. New system can be developed, or an existing system might be updated. Nevertheless new architecture must contain new modules for selected knowledge support.

Programming and technical development must be obviously based on outputs of previous steps.

Usage of internet and knowledge in education process

Classical education form, which includes books resources, needs to be completed with educationist commentary. In a process of education for informatics field of knowledge there are several problems, which are related to high fluctuation of sources data. Reliable sources could be web sites and forums. Of course those sources cannot be included online in books. Solutions to handle online sources of education data are learning management systems. By using LMS students are able to access their education materials 24 hours per day 7 days in week. That enhances efficiency, flexibility and finally quality of education. Putting LMS as extension of education materials is showing us positive results. On the other hand accessibility of too many materials is reducing electivity of standard LMS. Student is disappointed and frustrated from too many requirements. He is not able to quickly find what he needs. Here the knowledge based principles finds their place of implementation. We can extend standard LMS by reducing materials quantity whit help of knowledge fundamentals.

Principle of Adaptability, knowledge and business processes

This principle brings support for individualized access to learner study. Principle can be considered as follows: Information about learner study progress is stored in a student model [6]. This information tells system rules for managing teaching materials from data repository and then learner is provided with these materials. If the

materials invoke a change in learner study progress, this information is again stored in student model.

Mostly used technologies based on principle of adaptability are [3]:

- Intelligent tutoring systems
- Curriculum sequencing (Optimal Path problem)
- Problem solving support technologies (Intelligent analysis of student solutions, Interactive problem solving support, the example-based problem solving support)
- Adaptive hypermedia systems
- Student model matching

These were only few technologies used in KBLMS with adaptability support. Theory of KBLMS is relatively new and is being constantly developed.

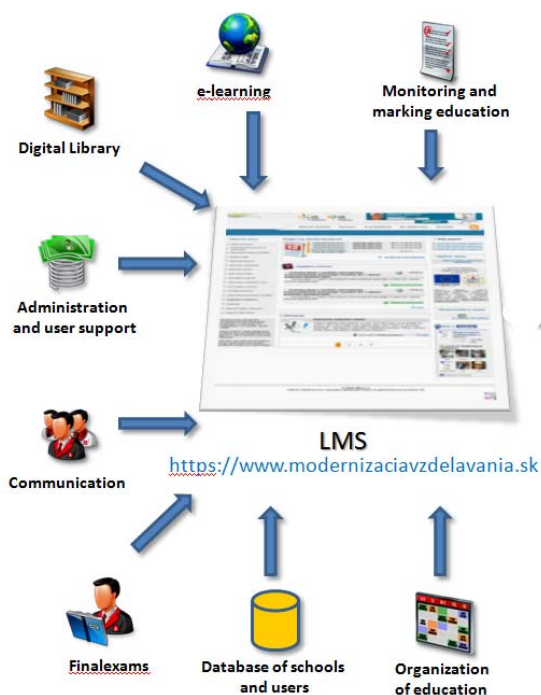


Fig. 1: Business support for LMS

III. MVP PROJECT IMPLEMENTATION INFORMATION

Our largest e-learning implementation is based on national projects (MVP) "Modernizing the educational process in elementary school" and "Modernizing the educational process in secondary schools". Both projects are prepared in accordance with the Operational Program of education supported by Ministry of Education of the Slovak Republic. E-learning and project is available for all regions in Slovak Republic. The basic aim is to activate teacher education reform - education system to adapt the knowledge society. The specific objectives of the project is to upgrade and modernize the content, methods and outputs of the learning process for new work responsibilities in the modern school of the 21st century. It is the aim of increasing the proportion of teachers participating in continuing education programs to obtain and develop the competencies needed for the knowledge society. Target group is more than 6850 teachers of primary and secondary schools as the primary target group

of students and 347,000 primary and secondary schools as a secondary target group. Projects is and will be implemented in years 2008 to 2013.

Education will be implemented by three modules as follows:

- Module 1: Digital literacy teacher (between 6 and 12 hours of attendance, and six hours distant form, implemented in October 2009 to February 2010): The aim of the module was to create the same "starting position" in general digital literacy for teachers involved (or get further development of digital literacy, which includes eg. the development of teacher competencies for lifelong learning, knowledge of safety issues and risks to pupils learning in virtual space, etc.).
- Module 2: Modern didactic teaching technique at work (in the presence 18 hours and 6 hours distance) module is to familiarize participants with modern didactic technology (ICT), its effective use in the educational process. Teachers are introduced to, inter alia, didactics work with images, animations, charts, with multimedia, audio, photos and music, the didactics with the Internet, with the didactics of digital devices, learn about new forms of organizing the educational process based on the use of interactive whiteboards, including alternative education systems and technologies.
- Module 3: Use of Information technologies in the subject (within 30 hours and 24 hours Distance): the aim is to create the proper context of modernization of education in selected subjects (create your own models of teaching applications of Information technologies in teaching in those subjects), as well as become familiar with examples models, applications of digital content with support for ICT in teaching in elementary and secondary schools. This module is the core of their own methodological training of trainees. Content is adequately and appropriately set up for the needs of target groups - teachers of selected subjects.

IV. LARGE SCALE IMPLEMENTATION

The projects MVP are supported by large-scale portal solutions (so-called educational portal project), which serve mainly to:

- Provision of information and presentation functions, and as an information base about the project (project information, cooperation and interdependence with selected existing, educational portals in Slovakia, etc.)
- Needs of the organization and administration of the educational process (organization of courses in education projects (inclusion in the study group feedback)
- Needs of the project (promotion of "blended learning": accessing learning materials for distance learning part, communication tools, knowledge testing)
- Needs of the digital library as a knowledge base (repository of educational materials and methodologies, support materials: books designed for

teachers, model lessons created using ICT teachers in the project, supporting methodical videos, collection of creative materials created by teachers during the project etc.)

- Continuous control over the work of teachers involved in projects (such as teachers, according to published criteria regularly provide information on the use of technology in teaching delivered by his subject, in preparation for teaching, for experimental testing of new methods of using Information technologies.

Our solution involves custom user controls and custom web parts. Some of them are show on the figures below :

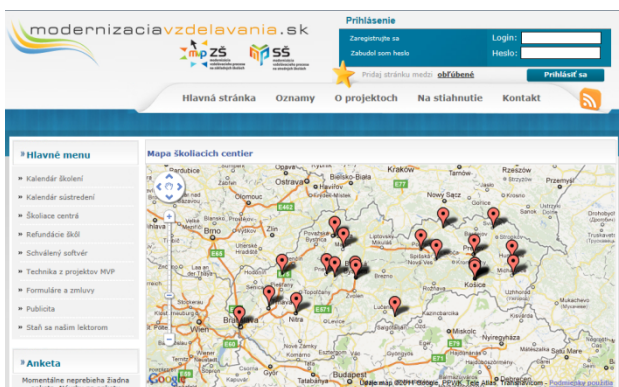


Fig. 2: Learning center map overlay

Our E-learning is supporting over 25 learning centers all over the country. System is autonomous for each of them. Giving them opportunity to manage lectors and learning times they can achieve all administration and education goals easily (Fig. 2).

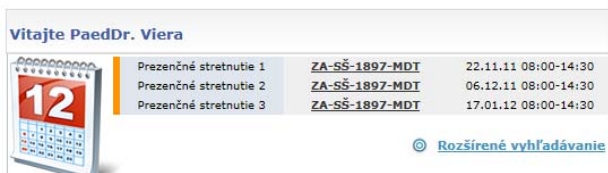


Fig. 3: Important events and times

Personalization of our E-learning is giving us opportunity to individually handle all important events for each of our users and user roles such as presence education, final exams and so on (Fig. 3).

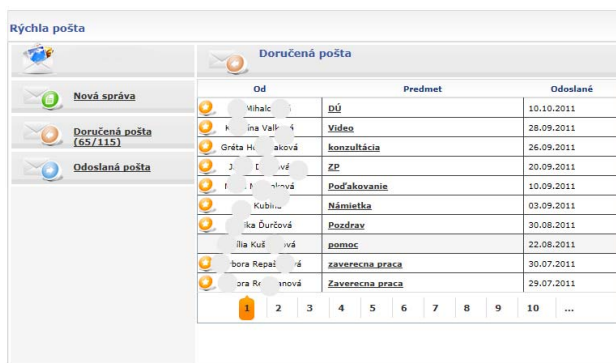


Fig. 4: Communication tools

One of the E-learning core functions is support of communication tools. Giving students and all users' opportunity to use our email client interface they can easily and clearly view and send messages to specific groups or users related to their education process (Fig. 4).

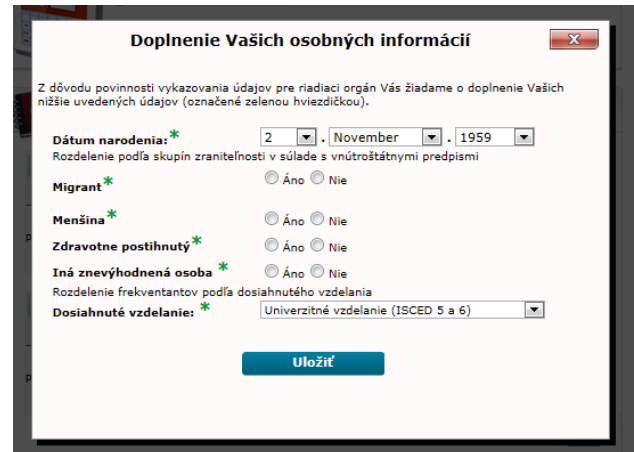


Fig. 5: Warnings and alerts

Years of experiences related to projects support and education shows us that satisfy all necessary administration data and requirements is thought to accomplish. To reduce the risk of failure in this problematic our E-learning is supporting warnings and alerts for users that are overdue important dates or data sets (Fig. 5).

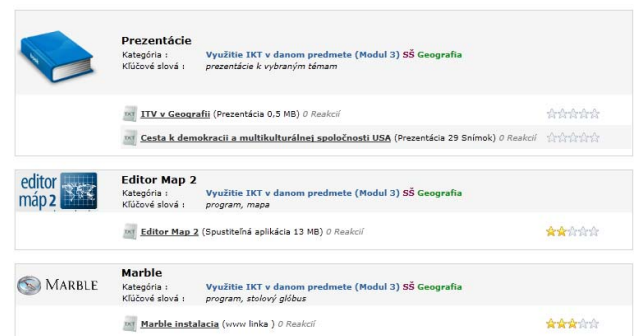


Fig. 6: Digital Library

One of the main features to support better sources of education data is our implementation for digital library. All object stored in digital library are categorized. Each object contains specific Meta data information which helps us to realize better search engines. Current status of our digital library concept is over 700 individual digital objects stored in 72 categories (Fig. 6).



Fig. 7: Custom learning content

Personalization of e-learning source and using knowledge principles in this part of our E-learning solution brings us to customer mercy and users satisfaction (Fig. 7).

Prehľad odovzdaných dokumentov					
	A1:	A2:	A3:	A4:	A5:
Bénesová Priska Dat. ZP: 14.08.2011	✓	✓	✓	✓	✓
Sopková Jarošlava	Neodovzdané	Neodovzdané	Neodovzdané	Neodovzdané	Neodovzdané
Kurucová Valéria	✓	✓	✓	✓	✓
Sabolová Agáta	✓	✓	✓	✓	Neodovzdané

Fig. 8: Scoring and assessment

All lecturers are using our scoring and assessment solution for specified student tasks. Later on system is using score values to calculate users actual percentage value of studies graduation (Fig. 8).

V. SOLUTION AND RESULTS

Innovation in the system involves

- Dynamic content visibility
- Knowledge based test generation
- Final exam support
- Business processes implementation

The goal is to achieve that singular parts of the course would not be accessible by the student immediately after his entrance to the course but they would be figured gradually. Therefore it is needed to design an adaptive mode for displaying the content of the course.

For every object of the course – lessons and their parts – a minimal score will be defined, which a student has to gain in order to view the particular object. This minimal score will be defined by the lecturer of the course, so he will have control over the content of the course. The system has several adaptive modes to ensure better possibilities of adaptive displaying of the content.

Our implementation achieves global success of central usage in our country. As a part of research and result of our work we present following third party statistics:



Fig. 9: Global usage

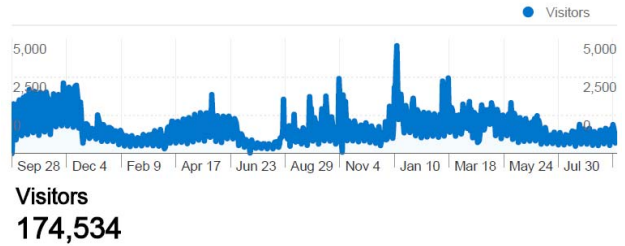


Fig. 10: Visitors overview

Visitors overview graph on Fig. 10 is showing us dependency on students vacation or global education process. Also improving the system brings us higher users visits.

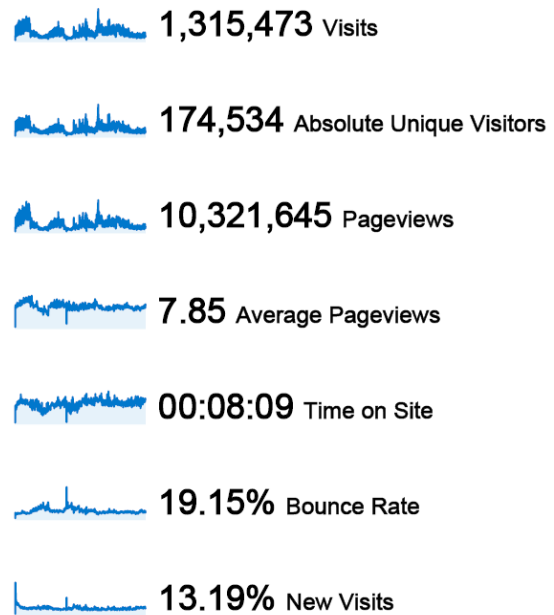
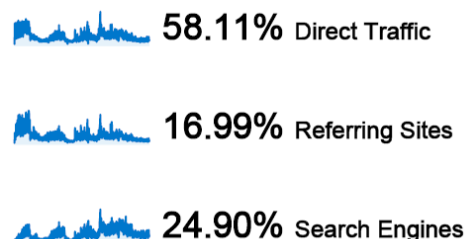


Fig. 11: Visitors overview in detail

Value of over 1.3 million visits in range of 2 years is considerable success in country with over 5 million inhabitants.



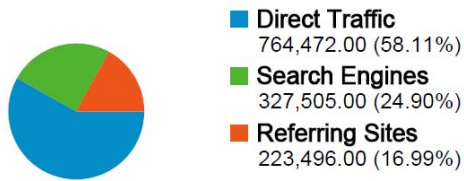


Fig. 12: Traffic Sources

Most of our users are visiting us directly. In fact that user are remembering our learning source and its location we are still improving our E-learning to make users more satisfied.



1,315,473 visits came from 67 countries/territories

Visits		Pages/Visit		Avg. Time on Site		% New Visits		Bounce Rate	
1,315,473	100.00%	7.85	7.85 (0.00%)	00:08:09	00:08:09 (0.00%)	13.20%	13.19% (0.10%)	19.15%	19.15% (0.00%)

Fig. 13: Map overlay

Business implementation involves and tries to achieve lower administration work for those who have to first of all teach – Teachers. By getting created all documents from system they don't have to spend long time after lesson to complete what is necessary for documentation. On the other hand business processes are useful for learning management. Mentors or others can quickly get important statistics or data export from systems which suggest real state.

Our solution of E-learning were presented on following public and technical events:

- Conference ICETA 2009 performed in November 2009 in Stara Lesna
- Conference MVP implemented in September 2010 in Banska Bystrica
- Conference 2010 ICETA implemented in October 2010 in Stara Lesna

- Roadshow Modern teacher implemented in November 2010 in Zilina, Presov, Kosice, Zvolen, Nitra and Bratislava

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REFERENCES

- [1] Lehman M. M.: "Lifecycles and the Laws of Software Evolution", in Proceedings of the IEEE, Special Issue on Software Engineering, 19:1060-1076, 1980.
- [2] Jarzabek S., "Effective Software Maintenance and Evolution: A Reuse-Based Approach", in Auerbach Publicatio, Taylor & Francis Group, ISBN: 0-8493-3592-2, 2007.
- [3] Grubb P.A., Takang A.A., "Software Maintenance: Concepts and practice", SE, ISBN 978-981-238-425-6, World Scientific 2003.
- [4] IEEE Std. 610.12, "Standard Glossary of Software Engineering Terminology", IEEE Computer Society Press, Los Alamitos, CA, 1990.
- [5] Pigoski T. M., "Practical Software Maintenance – Best Practices for Managing Your Software Investment", John Wiley & Sons, New York, NY, 1997.
- [6] Erlikh, L., "Leveraging Legacy System Dollars for E-Business", in IEEE IT Pro, May–June 2000, pp. 17–23.
- [7] Port, O., "The Software Trap — Automate or Else", in Business Week, 3051(9), 1998, pp.142–154.
- [8] Allen C., "Software maintenance – an overview", in British Computer Society, Programming & Software Articles, en-GB 3rd, February 2006.
- [9] Canfora G., Cimitile A., "Software Maintenance", in Handbook of Software Engineering and Knowledge Engineering, volume 1, World Scientific, ISBN: 981-02-4973-X, December 2001.
- [10] Fyson, M. J., Boldyreff, C., "Using Application Understanding to Support Impact Analysis", in Journal of Software Maintenance – Research and Practice, 10(2):93-110, 1998