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LMS SELECTION CRITERIA

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Abstract	The purpose of the document is to propose criteria and methodology to be considered in the decision making process of the LMS selection

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1. LMS selection criteria - an academic perspective

introductory considerations:

Regardless the fact that faculties and students (PT & SCHE) will be the primary users of the e-learning system, LMS administrators and IT professionals must take part in the process of LMS selection and requirements specification. This document aims to define the criteria by which all interested parties can give their contribution, and to determine the procedure and the selection method. Furthermore, it identifies specific requirements for modifications imposed by principles of instructional design.

In order to have appropriate requirements definition and LMS selection, those who are involved in the process should::

- Become familiar with the advantages and disadvantages of the available software solutions
- Establish the LMS selection committee, define the selection process as well as the selection criteria; and
- Ensure application of these criteria, in order to select the most appropriate LMS solution, in accordance with the characteristics of the institution and the needs of students .

This document is not intended to recommend one specific LMS, but to propose criteria and methodology to be considered in the decision making process. It is inevitable that, over time, there is a need for the LMS change, because of the new needs and development of the educational institutions. The document should help the project participants (PT & SCHE) specify requirements and make appropriate choice for the adjustment and deployment of the platform for distance learning.

1.1. LMS definition

The term

The term LMS is not completely clearly defined.Several slightly different terms are used for the same concept. The most commonly used are: CMS - course management system), VLE -

Virtual Learning Environment, LCMS - learning content management system), VLS - virtual learning system, learning portal, or e-learning platform (e-learning portal). Each of these terms has a slightly different meaning depending on the specific interpretation. Maybe this system should be called "instructional management system", since instructors and not students determine the parameters for learning. However, for the purposes of this document, the term LMS will be used in the context of complex integrated software that supports the development, delivery, testing knowledge and administration of traditional F2F courses, "blended" or online learning systems.

Educational institutions use LMS software for planning, organization, evaluation and monitoring of the learning process. With this software they centralize: the preparation of courses, content and resources; content delivery and monitoring of student activities, such as discussions and collaboration; assessment administration; collection and presentation of points and grades. All these activities takes place behind the "virtual scene", which provides authentication, security and privacy. Modern LMS systems provide a whole set of information about student activities, which are available to administrators and educators from various perspectives. This information can be analyzed to detect the typical pattern of learning or behavior and can help in finding ways to support students in a better way. LMS can help educational institutions to maintain the integrity of the educational program, effectively develop and deliver courses, facilitate communication and collaboration, and evaluate students. LMS can be used for all three types of learning: the traditional F2F, online and blended.

Today there are over 500 different LMS's that are in use. The academic community in Serbia tried out only a few of them.

Each LMS is unique. Some of them allow users to implement different scenarios and approaches, such as predominant orientation to the content (content-centric), to the connection (network-centric), to activities (activity-centric), or to a linear or branched approach. Some systems are better at delivering asynchronous instruction, while others are better at synchronous mode of instruction delivery. Some LMS systems deliver content to students and allow the assessment using mobile devices, while others do not have that option. Therefore, instructors should identify available possibilities and use them adequately in their instructions. It is necessary to carefully analyze available tools and their functionality in order to be implemented adequately. Selecting the right LMS depends on many factors, including the age of students, the type of teaching and learning methods, experience of lecturers, as well as the objectives of the educational institutions.

1.2. LMS selection challenges

Educational institutions can use the LMS software for different needs. However, despite the numerous benefits that can be obtained when the application, selection and implementation process sometimes does not give the desired results, due to many reasons:

- The profession does not have a crucial effect on the decision, but some other factors such as policy.
- There is no adequate commitment to the process, because it takes time before the results come.
- There is no adjustment with the education plan or with the development direction of the institution.
- There is no correlation with how educators teach. The LMS implementation may lead to the review of teaching methods.
- There is no possibility of recognizing the need to create the cultural changes needed to achieve success. Resistance and obstruction to changes may occur, especially among those who become aware of their shortcomings in the implementation of the new LMS.
- There is no organizational readiness during implementation, that is, the lack of an organization in which everybody knows their responsibilities.
- There is no appropriate training for instructional design, for students and IT experts.
- There is no support for the quality system, including pedagogical and technical support.
- There is no focus on the teaching quality design.
- The appropriate level of computer skills of students and instructors is not satisfactory.
- User-friendliness of the software is not good. Software must be easy to use, even for beginners.
- The Commission for the LMS selection didn't examine enough and found the answers to the needs and concerns of potential users, nor checked the information of the sellers and external experts. Also, it didn't provide assurance that the chosen LMS can actually perform tasks required by the users.
- Management of the LMS implementation project is not effective, ie. it is not ensured that the process of selection and implementation become successful.

More details on the reasons for the failure to implement the LMS can be found in Alison Bickford's document, "Tips to Help Avoid eLearning and LMS Project Failure," Connect Thinking blog, 13 August 2013. URL:
http://connectthinking.com.au/tips-to-avoid-elearning-lms-project-failure/

The implementation or the LMS replacement can lead to significant disturbances within an educational institution, and to significant changes in expenditure, time and money. It's the fact that it is very difficult to determine the return on investment (ROI) within the teaching process. Therefore, the cost of the LMS investment must be taken into account. These costs can be

compared with the costs of administration, human resources, salaries, and equipment procurement. With such comparison, it becomes clear that the costs of acquiring, leasing, and/or technical support for LMS are not so great. After implementation, the LMS becomes "critical" systems on which both instructors and students depend 24 hours a day. LMS becomes the most valuable software (or possibly the most hated software) in the institution. Also, one can ask the question, "What is the price to be paid if this investment is not implemented?". For example, a smaller number of enrolled students, diminished reputation, or the institution is not listed among innovative and competitive ones. When selecting LMS, the influences of short-term and long-term effects of its implementation must be carefully examined.

1.3. Proprietary, Open-Source, and Cloud-Based Alternative

The choice between "proprietary", "open-source" or "cloud based" LMS is similar to the choice of religion. The choice depends on what you believe in. Depending on the educational priorities and how the software is configured, any of these three types of software can satisfy all the needs. In any case, it is necessary to carefully consider the general statement of ownership, and compare it to the open source LMS software. You must be aware of the advantages and disadvantages of these options. Also, it is necessary to examine each LMS, using the criteria set by the potential customer. Regardless of the choice - and before deciding whether to opt for a commercial LMS LMS or alternative - the key characteristics that are important for the educational institution must be identified. They have to clearly separate the needs from wants. In addition, the impact of the LMS selection on the current operation should be determined. For example, whether the LMS solution will:

- Ensure reliability/stability, flexibility, scalability and needed security of the institution?
- Enable seamless integration with existing systems - both software and hardware?
- Require additional training of IT staff? If training is required, can it be provided remotely, and how much it will cost?
- Require hiring additional staff with skills that differ from those of the existing staff? What is the total number of employees to be hired for the normal functioning of the LMS?
- Require extensive maintenance and support over time? Do sellers offer support models that can be covered by existing budgets?

Proprietary LMS

Proprietary software is developed and owned by for-profit companies. From customer's point of view, this system is a closed system because the user is not entitled to refine and improve it. Typical representatives of this group of software are Blackboard and Desire2Learn. The **advantages** of such choice are:

- **The reliability of software**, because it was made by professionals who have invested a lot in order to make effective product.
- **Security,** because behind such software usually stands a company with serious references.
- **Up-to-date**, because the product has to be competitive in the market. Truly, the implementation of innovative ideas takes time sometimes.
- The **connection** with business systems such as finance, personnel, etc. This practically means that LMS is produced with the intention to support the integration with large software companies, such as SAP.
- **Good support** by the company which provides training, technical support and warranty service period..
- **The possibility of hosting** software on the hardware equipment of the company which developed the software.

Potential disadvantages:

- **Price.** Proprietary software can be quite costly.
- Users and organizations do not have **access to the source code**, which means that do not have the possibility to adjust the software, to add new features, or to rapidly fix identified deficiencies.
- **Up-to-date.** Proprietary software is not always up-to-date.
- Development companies may decide to suspend production of LMS.
- Some users think that proprietary software is too cumbersome and restrictive, and often take the open source solutions.
- Exclusively server installation. Companies can decide on the availability of software for servers only, without support for personal or laptop computers.
- **License agreement** may contain provisions that restrict the manner of implementation, distribution and administration..

Open-Source LMS

Free (open-source) LMS software is developed by individuals or consortium who are motivated by different reasons, the most common one is the belief that they have a "better idea" of how LMS should function. Moodle is one of the most popular LMS, developed by Dougiamas Martin, a programmer who was frustrated by the LMS he had used at the Curtin University. Martin's

elementary education has led to the Moodle system that is built on the theory of "***social constructivism***". This was a revolutionary approach because most of the LMS systems were built around a set of tools rather than pedagogy. The majority of commercial LMS systems is a "tool-centric" while Moodle is "learning-centered".

Another major open-source LMS initiatives, **Sakai**, started in late 2003 by four large traditional universities: MIT, Michigan, Stanford, and Indiana. They perceived a common interest to develop an "Open Source Virtual Learning Environment". About 350 institutions using Sakai initiative soon joined the initiative. Sakai Project is defined as "technology of the dynamic creation of a community that enhances teaching, learning, and exploration" through the spirit of cooperation of the community.

Some of the **advantages** of the open-source LMS software are:

- It can be easily be provided, since most of them are free, especially the parts that provide basic functionality.
- It allows users to examine source code and make necessary adjustments.
- It allows users to ensure constant improvements of the software that are available for all.
- It was built within a community that cooperates and is open to new ideas.
- It was developed as a result of the efforts of passionate fans of the idea of "free software".
- The possibility of a relatively easy adjustments without major technical support.
- A good alternative when the educational institution is not able to finance commercial solution.
- Avoids restrictions that may be imposed by the administration.
- The possibility of collaboration with others.

Potential disadvantages:

- While open-source software can be free, it needs investments in hosting, maintenance, upgrades and additional storage space or database support.
- It is often necessary to provide resources for the integration of the LMS with existing business management system.
- Technical support can be a significant challenge, especially if the technical team of educational institutions is not familiar with the technology on which the LMS is based.

- The quality of the code that is used in the LMS can be problematical. However, on the basis of the "Coverity Scan Open Source Report" annual report, the difference in quality between commercial and open-source software is getting smaller and is now minimal.
- Robustness of free software can be questionable.
- Some free LMS systems don't have implemented appropriate security mechanisms required by the administration of educational institutions.
- It is difficult to identify the culprit if the implementation of the LMS goes in a wrong direction.
- Problems can arise when some "passionate" developer decides to abandon the project and start working on another similar project.

As noted earlier, the pros and cons arguments about the choice of one or the other solution depend on the point of view. It is the fact that more reputable educational institutions in Europe and America use open-source LMS software, but it is also the fact that Blackboard the most common LMS.

Cloud-Based Alternative

In recent years there is a growing awareness among educators about the existence of the third options for LMS. It is a set of complementary "cloud based" tools and services which are available to everyone. Some of these tools which may be useful in education are listed on the Jane Harts website "Top 100 Tools for Learning". Educational institutions can use a package of web resources such as applications for content sharing, social "bookmarking", social networks, applications for manipulating multimedia content, which are available on the "cloud".

For example, blog, MySpace, or wiki pages can be used as a place where course titles, content and activities can be post. Furthermore, students can be directed to Google Drive, where they can find needed documents or sync documents via Dropbox. Also, they can use Skype for communication and meetings, Flickr for photo sharing, YouTube for video sharing, and Camtasia to "capture" the screen content and to record audio content. In this way students can use the software to their own discretion, in accordance with their personal life or work environment. However, such use of tools for education assumes that all students can access and use these tools. This presumption may be wrong, because many students from socially and economically underdeveloped areas do not have such opportunities.

Using a set of tools instead of the standard LMS solution has certain advantages:

- **The price.** The costs are small, although in some cases they may be higher if users want a faster download, or increase the capacity of the storage area.
- **A larger variety of tools.** Instructors and students can choose the specific tools they need for different tasks.
- **Shifting the focus from content to activity**. Using online tools can change the learning process so that more emphasis be on activities rather than on the content, as students use collaborative tools in the creation of various facilities.
- **Familiarity.** Many students are already familiar with tools such as Facebook,Flickr, and Twitter, but as noted earlier, there are those who are not.
- **Extended access to the artifacts**. When students use the Cloud solution, they can continue to use it after the completion of courses in the educational institution. In addition, materials that are produced during the study are portable and can be made available to other students at any time.

1.4. The process of LMS selection

LMS selection is responsible and professional task which requires time and respect of procedures and arguments of the profession. The following is a typical process of the selection procedure.

1. Appointment of the working group for the selection of LMS
2. Precisely define the organization of the working group
3. Write down the selection process
4. Specify the target characteristics and functions
5. Make a shortlist of suppliers
6. Make a pilot installation
7. Make a selection

1.5. Features and functionality as the criteria for selection

As previously stated, the selection of the appropriate LMS is a complex and responsible job. Over time, the criteria and the selection procedures change. They are conditioned by the changes brought by new technologies.

The traditional method of selection involves drawing up a list of desired features, and a selection is made on the basis of the degree of correspondence with such list of functions.

A modern approach to the LMS selection should be based on the answer to the following question

What are the real chances for its application in the real learning process?

A positive answer to this question has the greatest weight. But the answer to this question can not be given without a systematic approach in the evaluation of individual criteria.

1.6. Criteria specification

Criterion 1: The time required for implementation.

In order to answer this question it is necessary to answer first the following questions:

1.1 Is it easy to use ?

1.2 Does it do what teachers / students need ?

1.3. Does it have an easy mobile access ?

1.4. How reliable is the estimate?

1.5. Does it make job easier to professors, IT professionals, administrators?

1.6. Does it save time to employees?

Criterion 2: Is it possible to adapt to the specific needs of the institution?

This criterion should help in establishing the facts relating to the flexibility and the possibility of adaptation, i.e. customization for the needs of educational institutions. For this purpose it is needed to answer the following questions:

2.1. Opennes

The degree of openness should be determined. It is needed to check the availability of the complete source code, as well as the existence of a suitable access API, and security checks.

2.2. The possibility for adaptations

Check whether there are public published API that allows "third" participants to easily "add" their applications to LMS, take data from it, or forward files to it.

2.3. Pedagogical flexibility

It is desirable that the LMS can easily support experimentation in the field of application of different pedagogies and enable the institution not to have limitations in the application of new teaching methods.

2.4. Support

Check the existence of support and in what form it can be provided. What are the available options and who are service providers?

Criterion 3: How reliable and secure is it?

LMS is "mission critical" applications for the educational institution. The reliable and safe operation is a prerequisite for successful use. What this means practicable? The assessment depends on the answers to the following sub-questions:

3.1. Are there installations on Cloud infrastructure?

A positive answer to this question indicates the maturity of the product, because the cloud installations, as a rule, mean that the product is reliable and safe, because in such infrastructure it is easiest to demonstrate these qualities.

3.2. Speed

Estimate if the system is fast enough for your particular case. Can it endure loads in extreme situations, and how it behaves if the number of users increases.

3.3. Security

Check what security measures are built. Read reviews publicly available on the safety, and experience of others.

3.4 Scalability

Determine what are the possibilities to expand the capacity of the system and how easy this operation is.

3.5 Availability (uptime)

In case that the "third party" hosting is being considered, check the statistics of the percentage of system availability. Choose a system that has availability greater than 99%.

3.6 Low risks

Determine the degree of risk with the new version installations and various types of data migration. Preferred are systems that can automatically perform those tasks with low risks..

Criterion 4: Functionality LMS is a mission critical APP. Its reliable and safe operation is a prerequisite for successful use. What does this actually mean?

Additional sub-questions:

4.1 Support for Learning Analytics

The system should be capable of parsing and aggregating the usage data on a daily basis. Thus prepared data should be easy to integrate with any data analysis tool. This will ensure the use of specific tools which provide queries and reports that the educational institution requires.

4.2 LOR Support

The system should have a built-in support for the organization of learning objects (LOR - Learning Object Repository) in the form of a repository in order to reuse learning objects(reusability) and share content among users in an easier way. Also, it is necessary to have an easy way to import and export content.

4.3 Graphical reports

It is very useful to have graphical system usage reports by students, professors and administrators. This makes it possible to achieve a new look at the use of the system and to provide feedback information to be used for measuring the efficiency of achieving the goals of learning and the need for additional help to students.

4.4 The integrated audio / video recorder

Audio-Video recorder should allow easy connection of audio / video comments as parts of the discussions or when evaluating students. This means that multimedia messages can be attached to personal messages, discussions or evaluations.

4.5 Integrated learning outcomes

It is desirable that the system has the ability for the integration of learning outcomes in the LMS, as this can reduce the cost and effort of accreditation of the institution. Outcomes connect activities at courses with the competencies that are defined at the level of institutions, so that the student evaluation can be significantly easier. And when all this is in accordance with the stated learning outcomes, it can improve performance that student achieves.

4.6 Automatic tasks

When creating or editing tasks they should be automatically forwarded to the syllabus, diary and calendar, in order to save time and minimize effort for repetitive tasks. In general, all repetitive tasks should be automatized and thus provide significant savings in time.

4.7 Choosing the notification type and manner

It is necessary to have a notification control system. Thus, for example, there should be a possibility to choose when and how to send messages on the announcements of courses, date changes, etc. There also should be a choice of how messages are forwarded: by e-mail, text messages, via twitter or through any other web service. An option for selecting the sending frequency should be available too.

4.8 Easy to use

A clear, intuitive and easy to navigate user interface is a prerequisite for the user satisfaction of any system. For LMS it is of particular importance, as it reduces frustration, reduces maintenance costs, and primarily helps users to focus on content and learning.

4.9 IOS and Android

The learning process takes place everywhere. Therefore, the availability of LMS or its individual parts on mobile devices that use iOS or Android is of enormous importance.

4.10 Customized navigation

Organization of links related to courses should be flexibly. For example, courses which don't have content yet, do not need to appear or should appear automatically when their

content is published. Also, there should be the possibility to reorganize the order and links layout.

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4.11 File Download and Upload

Sometimes it is convenient to use external tools in offline mode. For this purpose it is necessary to have a simple mechanism for exporting and importing packaged course files.

4.12 SpeedGrader

SpeedGrader is an extremely useful tool. Those who use it often ask themselves how others can "function" without it. SpeedGrader should be a single framework for reviewing submitted students' papers, and a possibility to write comments (including audio and video). This should not be just an improvement and accelerator of the evaluation process, but should include sections on learning outcomes, and thus standardize measurement mechanisms. Marks should be automatically forwarded to the marks log, and feedback communication with the student is raised to a higher level.

4.13. Profile

LMS should allow its users to create personalized profiles, in which they can write something about themselves, and also to enable connection with colleagues. Profiles should include a short biography, links, preferred modes of communication, photographs. Account names should be used as navigation links to the collaboration area.

4.14. Audio and Video messages

Audio and video messages between students and instructors improve mutual communication, saving time and adding a human element to online courses. Researches show that students estimate the audio video messages in online courses as more effective than direct F2F communication.

4.15. Integration with multimedia content

Monotonous and stereotyped content may be enriched with interesting web links such as video content from YouTube or photos from Flickr. Therefore, it is desirable that in the descriptions, announcements, discussions and courses assignments, the LMS has the ability to easily incorporate links to such content, as simple "Cut + Paste" operations.

4.16. Stronger support for group work

Well-known is the advantage of working in groups. It is therefore very important that the LMS forces group work on solving problems, mutually controlling and reviewing and evaluating, sharing files, creating wiki pages. When such a collaborative workspace has the capability to integrate other tools such as Google docs, web conferencing or chat, then this is indeed a desirable environment that demonstrates all the advantages of online courses.

4.17. Students as creators of content

The possibility that students participate as creators of content opens up new dimensions in online learning. If LMS has the possibility that students in the learning process at all levels have the opportunity to complement the content using authoring tools, and content editors have the ability to regulate such content and share with others, then it is a functionality that can significantly enrich the whole system over time.

4.18. Web Conferencing

For complete online and "blended" courses, the possibility of organizing web conferencing through the existing LMS is equally useful, as it allows group collaboration, live presentations, and online students get the feeling that they are not "forgotten". Audio and video in real time with the use of a common table (white board) contributes to the further rapprochement of students and instructors.

4.19. Open API

In addition to the requirement that LMS is as accessible as possible to students and instructors, it needs to have an appropriate API that will enable it to "communicate" with other software products. Using various specialized integration it should enable educational institutions exchange information with Stud. Information System or similar portals. This can lead to development of various tools which can improve and facilitate the business process.

4.20. Support for web browsers

LMS should be available on any desktop computer or mobile device via a standard web browser. It is desirable that the LMS content is equally well displayed in the latest versions of Chrome, Firefox, Internet Explorer and Safari. This means that no special installation is needed, and compatibility issues are avoided.

4.21. LTI Integration

LMS should allow instructors to use different external services and utilities through LTI (IMS Learning Tools Integration) so that there are practically no limits to the expansion and improvement of usability of the online learning system. Extending LMS with a variety of online content, instructional video materials, tools for blogging and practically everything that can make the course more interactive and functional is very desirable.

4.22. Modern Web Standards

LMS should be developed using modern technology such as modern languages, AJAX, HTML5, JQuery or OAuth. Also, there should be integration with external services such as Facebook, Google Doc, and so on. All this contributes to a better collaboration between students and instructors.

1.7. Conclusion

Due to the fact that students highly evaluate LMS, it is important that educational institutions devote appropriate attention to the selection of LMS, which should be in line with the education plans, and satisfactory to all interested parties. It is not so important whether to choose an Open Source or commercial software. Each of them has its positive and negative sides of which can be discussed. However, it is important that the various stakeholders are involved in the decision-making process, to ensure minimum compliance and avoid opposition during the process of implementation.

Proper management of the project during implementation is also very important. If the institution wants broad practical application of the LMS enhancements, it is necessary to involve all stakeholders, and to effectively manage the project during implementation. The success of the implementation depends largely on whether LMS provides the expected characteristics.

Today's LMS systems have many functions. What are the features that best match the institution, students, educators and administrators? The answer to this question is specific to each institution. It is necessary to engage new experienced instructors and students to evaluate how the LMS is useful, flexible and user-friendly. IT technical staff should be included in the assessment of how the solution is reliable, scalable and secure. The software can have all the required features, but it can be difficult to use. Therefore, the only real test to try using it in a given environment and make sure that it meets the technical and organizational requirements. If the institution already uses a LMS, it is necessary to ensure the migration of the courses content. Current users, academic staff and students must have a significant impact in the LMS selection.

Students expect their instructors to use LMS efficiently. According to some studies instructors use only 50% of the available LMS functions. Instructors and support team need not only to

understand the benefits that LMS brings, but they must be trained to use them effectively. One way is to organize the exchange of experiences with other institutions and demonstrate ways in which functionality can be applied in specific cases. In addition, institutions should provide guides to good practice which should help instructors to produce better courses. Such guidelines may require the use of some rarely used LMS functions.

Recent studies show that students have high expectations in terms that they should be able to access lessons anytime, anywhere. They also prefer F2F interaction, e-mail CMS as a way to communicate with their instructors. It is vital for institutions to choose the LMS that will provide them the flexibility, scalability, stability and robustness. An efficient and safe LMS which would be able to provide online, blended and classroom teaching. However, the acquisition of an LMS solution can be fully justified only if instructors are fully engaged in its using, in the communication with students, and if they have adequate support in the development and delivery of courses. LMS must meet the needs of all stakeholders and must coincide with the priorities in the process of learning which have been designated as an institutional strategic plan.