IMPROVING THE PROFESSIONAL SKILLS IN GREEN CONSTRUCTIONS THROUGH ONLINE TRAINING

Erasmus+ Strategic Partnership KA2

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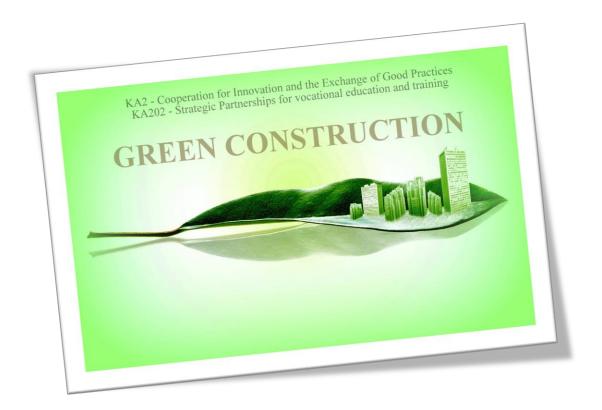
O3 - Final Report

SELECTION OF THE E-LEARNING ENVIRONMENT

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INTRODUCTION

AIM OF INTELLECTUAL OUTCOME 3

The project aims to develop training product with innovative multimedia modules to meet the identified needs of the European construction sector of green skills of low-qualified workers and young people who have a choice of profession. In O3 the partnership investigated the e-learning solutions and Learning Management Systems (LMS) appropriate

- To edit and publish the interactive digital learning contents,
- To serve as a motivating, inspiring learning environment for the students,
- To support the communication, collaboration and knowledge sharing among the actors (students and students, trainer and students)
- To support the activities of the trainers (tele-coaches) like assessment of the performance of the trainees.

The web-based multilingual modules aimed to increase the professional trainings in green construction, and to reach a significant increase in the motivation of construction workers to qualify thanks to the interactive and practical aspect transfer of knowledge.

THE WORKING PROCESS AND RESULTS

The final decision was based on a collaboration of three partners:

- European Center for Education, Science and Innovation (ECESI)
- iTStudy Hungary Számítástechnikai Oktató- és Kutatóközpont Kft. (iTStudy)
- Schnellkraft Personalmanagement GmbH (SchnellCraft)

In the working team ECESI was responsible for the theoretical background of the selection, iTStudy represented the expertise regarding the technology (developments of LMS, interactive digital learning content and online courses), while Schnellkraft provided of the human side of teaching and learning in online environment.

As a first step professors Margarita Todorova and Georgi Todorov (European Center for Education, Science and Innovation, Bulgaria) carried out a preliminary analysis of the existing e-Learning solutions, and provided a study about the main concepts of distance learning supported by web-based ICT platforms of the 21st century. Their study includes a classification and requirements of "Electronic Distance Learning" as well, and a comparative study about the two Learning Management Systems most widely used by the education all over the world: Moodle vs Blackboard.

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Based on its many years' long experiences iTStudy described the new features of the open source Moodle (**M**odular **O**bject-**O**riented **D**ynamic **L**earning **E**nvironment) system.

THEORETICAL BACKGROUND

FROM DISTANCE EDUCATION TO VIRTUAL LEARNING ENVIRONMENT (VLE)

At the present days, the wide use of computers, the Internet and the mobile technologies in facilitating learning seems likely to provoke an explosion in distance learning. Certainly, these technologies are radically (and rapidly) changing the academic, industrial, and economic environment.

A distance learning class is one in which the students are geographically separated from the instructor. Distance education courses use a variety of teaching methods, strategies, and technologies. There are Interactive Videoconferencing (ITV) courses, online courses (taught using the Internet), Tele courses (videotaped lessons) and 'Hybrid' courses that combine several different technologies with a traditional face-to-face component. For example, you may find that some distance education courses require students to visit the college campus for a face-to-face orientation before the class begins, and that many ITV courses have a large online component.

Current day data shows that most universities offer distance learning degrees or certificates (undergraduate, graduate, doctorate and certificate programs). VLE is also widely used in the area of Training and Vocational Education Teaching (TVET) [45].

The main characteristics of the VLE are [3, 8]:

- Students enrolled in distance learning programs are typically older than traditional students;
- Distance learners often have families and full-time employment, so ease of flexibility is desired;
- Distance learners tend to be highly motivated and self-disciplined;
- Distance learners are self-directed learners;
- Distance learners often seek education to increase work status, get promotions or to keep current employment;
- Students have high levels self-efficacy;
- All of these attributes lead to a successful distance learner.

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SWOT ANALYSES OF VIRTUAL LEARNING ENVIRONMENT - VLE

Strengths	Weaknesses
- Access from nearly anywhere that has Internet access (irrespective of the place of living, health condition and other issues, preventing traditional education); - Flexibility; - Allows for independent learning; - Ability to work and attend different educational organizations (universities, schools, training centers, VET centers etc.) at the same time; - Ability to attend classes even when sick; - Convenience; - Adaptability and ability to attend educational intuitional in other states or regions. self-discipline; - Organization and good study habits; - Less travel; - Students have access to new and improved emerging technologies; - Ability to improve quality of instruction; - Reduces costs to the institution offering classes because there is less need for on campus space and upkeep;	- Cost- distance learning is investment driven (virtual databases, libraries, IT providers, program development costs); - Labor intensive and more time consuming for both the teacher and the student; - Inaccessibility to library or other learning materials; - Limited student personal contact to the professor or other students; - Potential for fraud or plagiarism; - Procrastination; - Lack of focus; - Learning disabilities, such as dyslexia; - Cost of computers and other materials for students; - Limited by internet access and technology understanding; - Lack of direct and immediate contact between students and teachers; - Some difficulties in the process of student' testing; - Oriented to the motivated and responsible customers; - Applying learning technologies in the teaching process using shock therapy method, instead of non-evolutionary; - Lack of strategy and concrete approaches for implementation VLE in teaching process;

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- Time saving; - Increasing the profitability of education; - Rapid connection with students any time; - Essential extension the number of students, including vocational education and training; - Open options for education and learning resources; - Possibilities for analyzing the teaching process; - Monitoring students-teachers interaction; - Using a large scale of different methods and approaches for delivering teaching content (radio, TV, audio/videoconferences, e-learning/m-learning, webinars); - Flexibility in offering learning content – where and when; - Possibilities for teaching in individual mode; - Possibility for creating personal plan and schedule; - Interaction with teachers.	- Not enough number of specialists of high qualification with knowledge and skills in the field of distance technologies; - Lack of methodology and concrete approaches for VLE; - There are no effective methods for students' orientation in Internet information space; - Absence of public organizations in the domain of VLE.
Opportunities	**Threats**
- Ability to reach more a wider group of students, reaching students who do not currently able to attend college; - Expanding market potential by increasing access to education; - Shared resources leading to increased collaboration; - The ability to increase equality and diversity in the higher education arena;	- Increased costs to create and maintain complicated databases and online libraries; - Difficulty recruiting and keeping quality instructors; - Difficulty engaging students in a manner that is conducive to learning; - Multiple responsibilities at home, which may not leave a student enough time to commit to distance learning; - Numbers of enrolled students is declining in recent years despite increased offering of degrees;

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- Students are more easily accepted to distance programs when compared to brick and mortar institutions; - Opportunity for teaching disabled people; - Possibilities for people, which are travelling to be educated; - Increasing and deepening knowledge of customers in certain domain through project activities, competitions, online testing, and so on; - Preparing exams for increasing vocational qualification; - Improving the professional knowledge and skills in different field, including green construction; - It is a channel for delivering innovative knowledge in general, and especially towards the vocational education; - VLE has adequate and flexible reaction to society needs and ensures realization the right for education for all citizens; - Possibilities for receiving educational services from prestige well known universities and educational institutions; - Increasing the educational level of the population because of arising the accessibility educational organizations; - Improving economic indicators due to receiving education without leaving workplace; - Transition of educational system to the new innovation stage.	- A completion rate of enrolled students is stagnant; - Rising costs of technology; - The ever-changing dynamic nature of technology; - It is possible to exchange personal results of testing with somebody else's; - Weak technical skills of some teachers; - Negative influence of computers and Internet to human health. - The high stage of the concurrency in between the organizations, offering VLE services in Internet

The SWOT analysis resulted in a better understanding and orientation of online learning environments and services. It helps to select the most suitable VLE infrastructure for mediating the learning content about Green Construction.

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CLASSIFICATION AND REQUIREMENTS ON VLE PLATFORMS

Platforms for distance learning offer a full set of instruments for creating and developing virtual environment. There are a wide variety of such kinds of platforms, which can be generally classified according to the level of universality, the target domain and the type of customers.

- *Universal*

They are aimed at massive using in educational institutions from different domains of human knowledge and practice. They are using for teaching a very large quantity of students from different countries. They offer long and exhaustive list of possibilities and functionalities;

Examples: Moodle, Blackboard, Learning Space, Top Class, eLSe Learning Shell, Fair Share LMS,etc.

- *Corporative (specialized)*

For teaching a small group of corporative customers, in more than 570 corporative platforms for VLE are bravely described. Very few numbers of them are defined as platforms, oriented for construction users (only 3), and about 30 from then – for small and medium enterprises.

According the type of software and the way of its spreading within the customers:

- *Commercial platforms for e-learning*

The buyer of such kind of VLE receives guarantees that it will meet the needs and requirements and will achieve the goals. This is of course true only if it is the case of carefully investigation before buying the platform. The most important disadvantage of these packages is the price. Beside basic price the user organization has to pay some money for every student, working with platform. The concurrency in the educational software is very strong. These packages are upgrading very often, and these upgrades cost additional money. In many cases producers even are not adding new functions. They simply are correcting bugs of previous versions in order to ensure platform stability. All of these extra costs are paid by customer.

There are a lot of commercial platforms such as Desire2Learn (D2L) [23], Docebo LMS [30], eLSe-Learning Shell [15], Fair Share LMS [16] etc. Typical representative of this kind of systems is Blackboard [12].

- *Open source platforms*

These platforms are just the opposite the commercial platforms. Open source code is accessible under GNU – General Public License, which means that they can be used freely by all customers (it does not

mean that they are always free of charge). Software application can be downloaded from Internet and the license will not restrict using of the software package by any customer or group of customers. This kind of license gives the rights certain open source application to be modified and shared free of charge or for some fee. Beside this, a lot of documents (help, handbooks, etc.) are available via Internet online. Despite free access to open source software it is not suitable for every user. Without necessary knowledge and skills this software may cause some unpleasant surprises, especially for an inexperienced customer. Very often educational institutions want to make some changes, to add new functions and possibilities of the application, but for this purpose some technical knowledge and skills are necessary. In these cases, instead of financial resources, human resources are invested. Teachers now are playing the role of administrators, programmers and authors of learning content at the same time.

Examples of Open source platforms: ATutor [25], Claroline [26], eFront [27, OLAT [28], Sakai [29]. Dokeos platform [24] can be delivered as commercial and as open source platform. Typical representative and the most spread system of this kind of platforms is Moodle [11].

Requirements on VLE platforms

Some basic requirements to virtual educational platforms are herein after formulated [31].

- To permit creating Web-based courses, characterized by the interactivity, assess ability, using different media (text, graphics, video, animation, music, even augmented reality);
- To include tools for supporting statistic data of courses, registration site visitors, visiting courses and its units, success of student and assessment his knowledge, the stage of understanding and obtaining teaching content, and so on.
- To offer synchronous and asynchronous communication in between teachers and students using different tools (e-mail, chat rooms, conferences, webinars etc.;
- To have interface in different languages and easy switching from one language to another;
- To use free of charge software tools, to be not expensive and more accessible;
- Not to require huge resources from the server;
- It should be provided against corruption of the disc, on which it is installed;
- To be protected from unauthorized access.
- To aloud easy and fast upgrading.
- Do not require specific knowledge and skills of teachers and students in the field of Internet programming and Web design;
- To be compatible with the most popular operation systems and Web browsers;
- Do not require on the first stage of uploading to install some extra and additional software applications on user's station, besides some standards packages;

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- To be universal and in the same time to allow adaptation to structure and requirements of certain university;
- To have the possibility for implantation in structures of distance education centers and virtual universities;
- To be compatible with other systems with similar purposes and to allow teaching content import and export.

The requirements listed above can be used for appropriate and reasonable selection of VLE platform for the need of Green Construction e-learning solution.

A COMPARISON OF MOODLE AND BLACKBOARD JUSTIFICATION THE CHOICE OF VIRTUAL PLATFORM

GENERAL COMPARATIVE INDICATORS

As it was mentioned before there are a big number of different software platforms for VLE, which makes it difficult a detailed analysis and to choose the right one. We have in mind the fact, that the most wide spread software platforms, presenting two main classes (commercial and open source) are Moodle and Blackboard. Different surveys reveal that these two systems are on the top 10 in the list of VLE platforms. They have very high degree of custom satisfaction (98%), and score (9.1 from 10) for Moodle, and 95 %, and 9.2 from 10 (for Blackboard) [44].

All this gives us the reasons for presenting below comparative analysis of the Moodle and Blackboard platforms, and to choose one of them. For the needs of such comparative analysis we used the following **aggregated** indicators [42]:

1. General features
2. Tools' comparison
3. Usability
4. Maintenance
5. Pedagogy

GENERAL FEATURES - MOODLE VS BLACKBOARD

What is Moodle? The virtual learning environments are the online representations of the tools and activities of the traditional classrooms, developed for creating and running online courses through the Internet. Among them Moodle is told the most popular all over the world.

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Moodle is a learning management system that lets you provide documents, graded assignments, quizzes, discussion forums, etc. to your students with an easy to learn and use interface. Moodle is open-source; meaning that the programming code that runs it can be changed to meet the specific needs of users and institutions. Moodle is also free to download and use; there is no licensing fee.

The online system enables educators to create their own private website filled with dynamic courses that extend learning, anytime, anywhere.

The development of framework systems began in the 90s. The first solution was often criticized as it doesn't do anything but preserves the bad practices of traditional teaching within a modern technological environment. **For now, Moodle is supporting cooperation and collaborative content creation, and it integrates tools for establishing the elements of constructive pedagogy; it is so called web2.0 aware platform.**

The first version of Moodle was released on 20th of August in 2002, and in 2017 there are more than 80 000 registered Moodle sites and one hundred million users in the world.

The innovator of the system is Martin Dougiamas, an Australian educator and computer scientist at a University in Perth. His aim was to develop an open source application to support a social constructionist model of teaching and learning within Internet-based communities.

Link to the Moodle community: https://moodle.org

Moodle is an online course management system that is widely known and freely available. It can be used to create Internet-based courses and their websites, and for supporting the full-time, part-time and distance form of study. It enables teachers to create their own private website filled with dynamic courses for training anytime, anywhere. The product offers a complete set of learner-centric applications and collaborative learning environments that encourage both teaching and learning [44].

It is provided free of charge as a free and open software under the GNU General Public License and can be run on a common computer, tablet or smartphone equipped with a web viewer connected to the Internet.

Moodle is used in 228 countries, providing support for 139 languages, and has 161,813,376 registered users and 19,248,522 registered courses according to Moodle statistics on the Moodle website in July 2019.

Moodle is utilized by both institutions and individuals. The list of the former is long, including universities, high and primary schools, governmental departments, military, and health care organizations as well as airlines or oil companies. Home schoolers, independent educators, and special educators are among the individual users.

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Moodle has many different activity types: assignments, chat, choice, database, external tool, feedback, forum, glossary, lesson, quiz, SCORM, survey, Wiki, and workshop [19].

A number of programs, namely PHP, which is a script language embedded into html codes that work in a server-side; MySQL, which is a database management system that can run in the background and can respond to requests, such as a high-performance web server; and Apache, which is an open-source software web server that is completely free and has a high performance, are required before the Moodle program is set up.

Moodle supports also mobile learning, so it has its own Moodle Mobile application. It has responsive design for phones and tablets. Users can download and view some course resources. Its strengths were detected in following main features [31, 46]:

- Configuration and Organization, as it is based on a template principle, having intuitive interface with easy navigation.
- Learning content is structured in small units within wider topics, e.g. on a weekly schedule.
- Course administration where the access to selected files can be time-limited by the administrator or protected by password. Student's activities are automatically tracked, and students can follow their educational results.
- Contents and sources can be displayed in various formats (text, html, graphics formats, video- and audio-formats etc.).
- Evaluation and testing run in traditional forms (e.g. fill-ins, multiple-choice, true-false, matching, short-answer), which can be time-limited and/or protected by password.
- Cooperative learning, being based on the social-constructive learning theory, runs in groups, pairs, using a/synchronous means of communication, including Wikis.
- Discussion panels mediate teacher/learner and learner/learner communication.
- Possibility for easy and fast orientation in existing information data base and learning content. Otherwise, if a student spends a lot of time for this, he could lose his interest of studding in distance mode.
- The customer has the possibility to establish contact with teacher in real time for receiving on time consultation via chat and journal modules.
- Moodle gives detailed chronological reports about customer actions in order to avoid abuses as regards the learning content, chats and forums.

What is Blackboard? A brief overview

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The Blackboard Company was established in 1997 dealing with consulting services and technical standards for on-line education. This approach includes a user-friendly environment focusing on presentation of study materials, references, syllabuses etc. In 2005 the Blackboard Inc. Company merged with the competitive WebCT Company. The new entity continues to support both systems [20]. Blackboard is a set of platforms (Blackboard Learn, Blackboard Collaborate, Blackboard Mobile, etc.)For VLE the current Blackboard is used for on-line education by over 20 million users in more than 60 countries in the world. The system is available in more than 50 languages and it is used by more than 20,000 educational institutions.

Blackboard is also a very popular learning management system. It is an application that provides businesses and educators the ability to reach and teach their employees or learners via a virtual environment. This web-based software delivers a course management system, customizable open architecture, and scalable design that help users to combine the application with student information system and authentication processes. The main goal behind Blackboard is to create and deliver online courses and learning successfully to recipients with few or no face-to-face meetings [44].

Thanks to the flexibility of the Blackboard Learning System, it is easy to design a course curriculum or study schedules, and the continuation of education courses go on flawlessly. It also facilitates interaction between users, who can have basic discussion, and offers other collaborative tools [19].

The system consists of many communication and discussion features enabling active participation of students [21]. The possibility of the use of multimedia, an instructional option, is willingly utilized by teachers.

Blackboard strengths include following features:

- Increased Availability of the system available on the Internet and easy access were detected in the survey in [48].
- Learning content is structured in items, files, folders of all formats.
- Course of study in managed by calendar.
- Quick Feedback for students in the form of 10 types of tests, either automatically or tutor-corrected, was another strength discovered in the survey.
- Wide scale of communication tools, which cover standard a/synchronous approaches, and the virtual classroom for group communication, are provided to teachers and learners.
- Tracking, working towards obtaining statistical data about students´ activities in the course, and displaying their performance (study results) in the Gradebook.

GENERAL COMPARISON

Comparative analysis on the systems using some common basic indicators is given in tabl.1 [19, 44].

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Table 1

No	Indicator	Blackboard	Moodle
1	Price	Commercial	Free, open source
2	Open Source	No	Yes
3	License	N/A	GPL
4	Type	LMS	LMS
5	SCORM	Yes	Yes
6	Language	More than 20	139
7	Countries	More than 50	234
8	Written in	N/A	PHP
9	Video conferences integration	Yes	Yes
10	Operating System	Microsoft NT	-
11	Servers, Windows, Mac OS X	Windows, Linux, and Mac OS X	Cross platform
12	Database Server	N/A	MySQL
13	Web server	N/A	Apache
14	Mobile learning support	Yes	Yes
15	Overview of Features	Enhanced Cloud; Profile; Portfolio; Student Preview; Safe Assign; Data Management; Collaborate Integration;	All-in-one calendar; Bulk course creation and easy backup; Collaborative tools and activities; Convenient file management; Customizable site design and layout;

No	Indicator	Blackboard	Moodle
		Group Management; Grading Enhancements; Social Learning; Blackboard Drive; Calendar; Content Editor; Course Enrollments; Active Collaboration; Dynamic Content.	Detailed reporting and logs; Embed external resources; Manage user roles and permissions; Multilingual capability; Multimedia integration; Multiple progress tracking options; Notifications and automatic alerts; Outcomes and rubrics; Peer and self-assessment; Personalized dashboard; Regular security updates; Secure authentication and mass enrolment; Simple add-ons and plugin management; Simple and intuitive text editor; Supports open standards.
16	Position in Rating System	One of the top 10 Learning Management Systems.	One of the top 10 Learning Management Systems.
17	Score	9.2[1]	9.1*

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[1] **Smart Score™ system is used to evaluate the products. It includes the following elements:*

Main Functionality; Collaboration Features; Customization; Integration; Ease of use; General Impression; Help & Support; Security; Mobility.

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No	Indicator	Blackboard	Moodle
18	User satisfaction	95 %	98%
19	Customer Types	Small Business; Large Enterprises; Medium; Business.	Small Business; Large Enterprises; Medium Business; Freelancers.
20	Deployment	Cloud Hosted	On Premise

PROS & CONS

OVERVIEW OF MOODLE BENEFITS

Easy to use

A simple interface, drag-and-drop features, and well-documented resources along with ongoing usability improvements make Moodle easy to learn and use.

Always up-to-date

The Moodle project's open-source approach means that Moodle is continually being reviewed and improved on to suit the current and evolving needs of its users.

Moodle in your language

Moodle's multilingual capabilities ensure there are no linguistic limitations to learning online. The Moodle community has translated Moodle into more than 95 languages (and counting) so users can easily localize their Moodle site, along with plenty of resources, support and community discussions available in various languages.

All-in-one learning platform

Moodle provides the most flexible tool-set to support both blended learning and 100% online courses. Configure Moodle by enabling or disabling core features, and easily integrate everything needed for a course using its complete range of built-in features, including external collaborative tools such as forums, wikis, chats and blogs.

Highly flexible and fully customizable

Because it is open-source, Moodle can be customized in any way and tailored to individual needs. Its modular set up and interoperable design allows developers to create plugins and integrate external applications to achieve specific functionalities.

Robust, secure and private

 Committed to safeguarding data security and user privacy, security controls are constantly being updated and implemented in Moodle development processes and software to protect against unauthorized access, data loss and misuse. Moodle can be easily deployed on a private secure cloud or server for complete control.

Use it anytime, anywhere, on any device

Moodle is web-based and so can be accessed from anywhere in the world. With a default mobile-compatible (soon to be responsive) interface and cross-browser compatibility, content on the Moodle platform is easily accessible and consistent across different web browsers and devices.

Extensive resources available

Access to extensive Moodle documentation and user forums in multiple languages. Free content and courses shared by Moodle users across the world. As well as hundreds of plugins and add-ons contributed by a large global community.

MOODLE IS SCALABLE

From a few students to millions of users, Moodle can be scaled to support the needs of both small classes and large organizations. Because of its flexibility and scalability, Moodle has been adapted for use across education, business, non-profit, government, and community contexts.

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MOODLE IS MULTILINGUAL

Moodle's multilingual capabilities ensure there are no linguistic limitations to learning online. The Moodle community has begun translating Moodle into more than 120 languages so users can easily localize their Moodle site.

Source: https://moodle.org
Image source: https://languages.oberlin.edu

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Moodle is provided freely as Open Source software, under the GNU General Public License. Anyone can adapt, extend or modify Moodle for both commercial and non-commercial projects without any licensing fees and benefit from the cost-efficiencies, flexibility and other advantages of using Moodle

AUTHORIZING SYSTEM IN MOODLE

Moodle has a complex authorizing system in which the roles are described by the level of rights. The highest-level rights belong to the manager, who is the system-administration of the learning environment even with permission for defining the rights of all other actors of the platform.

Students can register, enter the course, manage their profile, access to learning materials, submit assignments, create contents, collaborate and communicate by using different tools such as blogs, wikis, forums, inside e-mails and messages.

Roles, user's permissions in Moodle

Manager, Course creator, Teacher, Non-editing teacher, Students, Registered users, Guest

The teachers can follow the learning progress of the students, evaluate their performance, creating learning materials, such as digital textbooks integrating multimedia contents (videos, pictures, and animations), glossaries, games, quizzes, questionnaires for self-assessments, exam tests, and facilitating the online collaboration of the participants through the forums, wikis and group assignments.

SERVICES OF MOODLE

The services of Moodle can be grouped into the sub-systems as follows:

- Learning Management System (LMS) – supporting the learning activities

- Content Management System (CMS) – supporting a structured content (document) management

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- Learning Content Management System (LCMS) – supporting of creating, editing and publishing digital learning content.

Similarly to the classroom teaching, usually not the teachers are responsible for authoring the textbooks. In Moodle there are different roles of teachers with different level of rights: teacher, course creator, and non-editing teacher. The teacher, whose task is facilitating the learning process in the online environment, is often called as "tutor" or "tele-coach".

The services of Moodle in details:

- Managing accounts, monitoring access, registration of users,

- Presentation of lessons and other learning contents,

- Managing the assessments of the students' performance

- Scheduling the students' tasks,

- Providing options for practice, publishing online tests, quizzes,

- Supporting the tutor's activities (organizing courses, managing enrollments, recording students' activity and performance, managing the evaluation of the students' performances, producing records and statistics)

- Supporting communication between teachers and students,

- Supporting quality management, for example course evaluation via students' feedback.

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DIGITAL COURSE COMPONENTS

- Module description

- Learning outcomes

- Core content

- Self-assessment quiz

- Learning guide, guide for tutors

- Learning instructions (weekly, daily …)

- Tiny Exercises

- Credited assignments

- Forum topics

- Feedback questionnaires from the participants

- Quiz question database

- Glossaries and games based on them

- Repository of video tutorials.

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EXAMPLES

iTStudy has been developing multilingual e-learning courses in Moodle platform more then 10 years long.

OVERVIEW OF BLACKBOARD BENEFITS

Blackboard Learning Management System offers a variety of distinctive benefits for learners and students. To start with, they gain *immediate and streamlined access* to all of its features, and work navigating an intuitive and reminiscent of social a network, that is even compatible with their devices. Basically, Blackboard *can be used on all types of smart phones and tablets*.

With Blackboard, it will *be easy to regain compete control on all learning activities* taking place in the organization, as the system also offers a great collaboration suite to keep learners connected. If you're an educator, on the other hand, Blackboard will ensure that you have a variety of methods to improve students' and learners' engagement and motivate them to use their maximal potential.

Blackboard *can also be applied to enhance competitiveness and professional development in corporate environments*, thanks to the fact it blends learning and real time support in a single product. There is a *variety of useful integrations with third-party learning management systems and applications* (and other type of business software) to ensure that data will flow seamlessly, and that manual entry will be absolutely restricted. Other distinctive features include: *Student previews, Safe Assign, Data Management, Collaborative Integrations, Calendars*, and much more.

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Extensions that help expand Blackboard's capacity are also available for corporate users, *covering all types of additional functionality*. *Customer support is always available* via several channels to ensure that users have no problems working with this system.

TOOLS' COMPARISON

Features can be compared along the following tools [42]:

- Course delivery: test types, automatic test support, grading, course menu, course management, assignments, online grade book, etc.
- Productivity: calendar, progress review, work offline, module page, etc.
- Communications: discussion forum, file exchange, mobile access, blogs, lecture recording, etc.).
- Student involvement: group organizing, wikis, student portfolios, etc.
- Content development: course templates, customization, instructional design
- Tools, compliance with standards, etc.

The analysis focused on comparing the above described four LMS systems reflected following criteria [43]:

- Tools intended for **generating contents**;
- **Communication** tools;
- Tools for **collecting and evaluating activities**;
- Tools for **co-operation and other possibilities** of the system;
- Price.

Following tools intended for **generating contents** were analyzed and compared: Page, URL, File, Folder, Legend, Book, Lecture, Dictionary (index), Syllabus, Lesson plan, Video, Integration (integration with study contents of other LMS).

Another compared group covered **communication tools**: Discussion panel, Chat, Reports, Inquiry, Comments, Blogs, Survey (question-form).

The group of tools for **collecting and evaluating activities** included: Task (On-line text, Set, Off-line activity), Test, Workshop (Self and Peer Assessment), Safe Assignment.

The **co-operation tools and other compared options** included: Group mode, Wiki, Virtual classroom, Calendar, Internal mail, Tracking, Statistics, Database, Language adjustment, Certificates.

The final criterion is **the price**. While Moodle are available free of charge, Blackboard has its license policy and its price depends on number of users and the tools used. Approximately the expenses are

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calculated $ 10 per user and year with Blackboard Learn [43]. Price for using this LMS is considered high, as a yearly license can reach 200,000 - 400,000 U.S. dollars a year if more functions are used [43].

The results of the assessment can be summarized as follows:

According to the results' analysis there are almost identical tools in Blackboard and Moodle.

The tools of Syllabus and Lesson Plan contain only the Blackboard as a direct tool. In the Moodle LMS this tool is substituted by a particular file.

Blackboard also contains Safe Assignment as a specific tool which is intended for protection against a plagiarism and for checking submitted tasks in reference to the central database. The system can maintain a database of before submitted tasks (for an organization or for a bigger association) and perform checking a current submitted work in reference to this database.

The examined LMSs include tools for cooperation, i.e. created tasks can be evaluated by students mutually (Moodle – Workshop, Blackboard - Self and Peer Assessment). Students thus can take part in generating contents (Wiki, dictionaries, and databases). Tools for communication were included in both LMS as well. There are discussion panels, chat and mails in different forms.

The criterion, which mostly distinguishes the LMS's, is the price. Moodle is free of charge and LMS Moodle tools do not basically differ from Blackboard, which are provided for payment.

Both LMS offer functionally equivalent services and the difference can be found to down fine details. A detailed features comparison is not intended here. Relevant materials can be found in [34, 35, 36, 37 and 38].

USABILITY

Usability is a very important issue for every instructor as it represents the dimension of efficiency, efficacy and satisfaction of the user to achieve a given goal by interacting with a specific tool. One can't find much difference between Blackboard Learn and Moodle after being well studied as adopted e-learning environments by a given institution. However, significant training is needed to set up classes and incorporate learning content with Blackboard. That's why we can find the system a little bit complicated. Courses that you are either teaching or enrolled in are listed in the My Courses panel. For each course the so-called Blackboard course shells, containing the main tools of the environment is set. One can find the interface to these tools heavy and not quite user friendly. Blackboard offers a multi-level folder like structure thus blurring the structure of the course that becomes somehow disorganized. There seems to be just too many buttons and levels presented to the users all at once. Sometime discussion boards are hard to be track and the replies could get lost. Finally some browser compatibility issues and problems with the HTML editor can be mentioned.

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Meanwhile Moodle is far more intuitive and permits good housekeeping when the course tends to become disordered. Moodle's single page unit based structure facilitates a modular design that permits to improve the overall functionality by adding new components. Once you have IT support and don't care about administration issues Moodle is simple and straightforward to use. It handles interactive content such as videos, audio, and websites. Moodle has an assortment of plugins that can assure additional functionality. We work in supporting students and frequently see the use of Moodle. Students are able to login to the portal, find assignments, and from there plan and manage their time. The system allows to clearly communicate the information and to open dialogue with the student. However, at times some functions are confusing and lack explanation. Once again, it's not easy to administrate the LMS only by yourself [42].

MAINTENANCE

As it concerns the maintenance, Moodle is supported by a large international group of users and developers. One of its strong points is the active online learning communities and collaboration activities. Blackboard also has its own organized communities. Though Blackboard is a commercial LMS, while Moodle has always been open source, the engagement of each product with its community of users is different [42].

PEDAGOGY

Moodle affirms attempts to support Social Constructionist pedagogy [39] that stimulates collaboration, critical thinking and task-based learning thus providing a social experience. Students are allowed to create a profile with a picture and to track who else from their course is online. Recent activities are also reported. There are wiki's and other tools that allow the production of collaborative objects.

There are no statements about underlying pedagogy in Blackboard Learn. Recent versions announced Social learning tools (Profile, People, Message and Space). These tools permit collaborating with students and faculty around the university area and at other colleges and universities with Blackboard Learn. Actually, this new global learning network connects users at Blackboard Learn institutions around the globe. In this way informal learning is stimulated.

Both LMS encourage contacts between students and instructors via discussion tools and notifications on recent activities. Collaboration among students is stimulated by real-time chat and group collaboration tools. Both systems are giving quick feedback and permit student to manage their learning process through online content and assessment tools. They provide also for multiple content formats and different learning paths. Summarizing Moodle and Blackboard Learn are quite similar in the presentation of leaning content.

Some pedagogical differences can be found in the organization of the learning material. Blackboard offers a folder-based structure, while Moodle presents the whole course on the same page split into units defined by the instructor. The embedded organization of LMS force the users to upload their content under the right category, instead of applying the own pedagogical style. The impact of LMS on the pedagogy and teaching is analyzed in [40].

Blackboard "tends to encourage a linear pathway through the content" [41]. When first enter Blackboard instructors see the default buttons of the course menu. It would be more natural to see a blank schedule into which they could create each week's or unit's activities. Blackboard default organization forces the instructor to think in terms of content types.

Organization in Moodle is not by type of content, but by week or topic, like a regular class syllabus. This format permits the instructors to decide what activities to do week by week or unit by unit, which does not constrain any learning style or teaching methodology. Although Blackboard does not limit the content, the inherent structure behind the Blackboard course shell could constrain the way an instructor designs the learning paths for the course [42].

CONCLUSIONS

The Blackboard Learning System (i.e., WebCT) ensures variety in course content and materials. In addition, the Blackboard Learning System assists students in their offline efforts. Curriculum design is supported by the two systems by providing course templates, thanks to which instructors can deliver course materials, define study schedules, and plan class activities. Regarding communication and discussion, both Blackboard and Moodle deliver discussion forums and chat rooms together with exchange of e-mails and files. The Blackboard Learning System also provides private folders and internal e-mail for students and gives them an option of making their own notes. As for performance assessment, systems incorporate assessment and grading functions. Course administration is embraced again by both tools by facilitating uploading of student data and course data in batches. The Blackboard Learning System is also equipped with direct data interfaces. It should be noted that there are certain similarities between Blackboard and Moodle such as option of student enrollments in courses, access to discussion forums, or taking quizzes and tests. The Blackboard Learning System and Moodle are about equal in terms of administrative features, collaboration, and instruction methods. Other common features are supporting file upload (e.g., Word, PowerPoint, audio), being SCORM compliant, allowing grading, providing course calendar, and monitoring students' participation [19].

The two of the LMS platforms shortly described above, MOODLE was our choice and subject of interest. The attractive features of consideration are [22]:

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- According to the full description this platform allows to be adapted for many operating systems (Windows, Linux, Sun and UNIX) and software environment (MySQL, Postgre SQL, MS-SQL Server, Oracle and Access).
- MOODLE can be installed at an institutional server and allows establishment and maintaining of courses from different categories kept in a catalog at a portal page. This way can be covered wide area of subjects and topics.
- MOODLE supports more services than others concerning course activities. The teacher arranges the modules in order the students will use them. The order is flexible and editing is possible in any time. The available modules are: Assignment, Choice, Forum, Journal, Resource, Quiz and Survey that answer the needs of our course project.
- Available course formats (Weekly, Topics and Social) give the templates for course setting, which facilitates the teacher design work.
- There are opportunities for uploading files of various formats that allow usage of materials from previous ordinary courses and easy extension of existing courses. Link to the web directory that contains the files could be given also.
- MOODLE supports many languages with opportunity to add extra ones.

When choosing an LMS, a reasonable question arises: what is better – a free open-source solution which requires further development, or an expensive product which is ready out of the box? This question reveals two general investment factors: initial price and future cost of ownership. Both factors strongly depend on institutional policies and instructors are expected to use the selected product. Moodle is a nice alternative for those that are looking for a full featured LMS with a relatively low cost. But the system customization to fit specific needs may require significant programming efforts. Blackboard is an industry-leading LMS, but it is expensive [42].

As it concerns functionality, there is no predominance. Moodle's learning content organization is more transparent, and the constructivist style is incorporated in. Blackboard seems to require precursory training for instructors and students while Moodle is intuitive and easy to use. These aspects also confirm our preference is to use Moodle as LMS.

And the last reason for choosing Moodle LMS for the needs of the project is that we have to take into consideration in the fact that this virtual platform is using for VLE in all project partners: Bulgaria, Germany, Latvia, and Hungary.

E-learning experts of the Consortium suggest to apply MOODLE as Green Construction online learning environment. Based on their many years long experiences this is the e-learning platform what will be able to reach the main aim of the project: to implement an inspiring, motivating, interactive platform for the training – by integrating the newest technology of online teaching, learning and knowledge sharing.

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