



InSIDE: Including Students with Impairments in Distance Education

**Delivery
PR1.3**

Recording of the LMSs

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Abbreviations

Acronym	Term
AT	Assistive Technology
DE	Distance Education
HE	Higher education
HEI	Higher education institution
ICT	Information and communications technology
InSIDE	Including Students with Impairments in Distance Education
Iwl	Individual with impairments
JKU	Johannes Kepler University
LMD	Licence, Master, and Doctorate
LMS	Learning Management System
SaaS	Software as a Service
UABT	University of Aboubekr Belkaid Tlemcen
UAE	Abdelmalek Essaadi University
UB2LA	Blida 2 University
UCA	Cadi Ayyad University
UDL	Universal Design for Learning
UIT	Ibn Tofail University
UM5R	University of Mohammed V in Rabat
UMMTO	Mouloud Mammeri University of Tizi-Ouzou
UOA	National and Kapodistrian University of Athens
UOM	University of Macedonia
US	University of Sousse
USFAX	University of Sfax
USTO	University of Sciences and Technology of Oran Mohamed Boudiaf
UTM	University of Tunis El Manar
ViHeMo	Visual, hearing, motor
WP	Work Package

1. Introduction

The purpose of this document is to present a review the current available alternatives of LMSs based on the study of the literature, previous researches and projects. A detailed list of LMSs with their advantages and drawbacks, their specifications and additional information by the manufacturer, as well as their potential use in the case of students with impairments, has been composed in order to serve as an updated guide in LMSs.

2. Available LMSs

Nowadays there are about 45 LMSs available to provide distance education (DE) and manage it:

- [aTutor](#): is an Open Source Web-based system, developed by [Inclusive Design Research Centre, OCAD University](#) in Toronto, Canada. It can be used to develop and manage online courses, and to create and distribute interoperable elearning content. Current version: 2.2.4.
- [Blackboard Learn](#): (previously the Blackboard Learning Management System) is a virtual learning environment and learning management system developed by [Blackboard Inc.](#) It is Web-based server software which features course management, customizable open architecture, and scalable design that allows integration with student information systems and authentication protocols. It may be installed on local servers or hosted by Blackboard ASP Solutions.
- [Canvas](#): is a free for everyone to use LMS system developed by the educational technology company [Instructure](#) based in Salt Lake City, Utah.
- [Chamilo](#) is a free software (under GNU/GPL licensing) e-learning and content management system, aimed at improving access to education and knowledge globally. It is backed up by the [Chamilo Association](#).
- [Claroline](#) is a collaborative eLearning and eWorking platform (learning management system) released under the GPL open-source license and has been developed by the [Université catholique de Louvain](#). It allows hundreds of organizations worldwide ranging from universities to schools and from companies to associations to create and administer courses and collaboration spaces over the web. The platform is used in more than 100 countries and is available in 35 languages.
- [Cornerstone OnDemand Inc.](#) is a cloud-based learning, talent management and talent experience software provider headquartered in Santa Monica, California. The company is publicly traded on the [NASDAQ](#) stock exchange under the ticker symbol CSOD.
- [Desire2Learn](#) or [Brightspace](#) is a cloud-based software used by schools, higher education, and businesses for online and blended classroom learning. It has been beveloped by [D2L](#), which is a global software company with offices in the United States, Canada, Singapore, Australia, Europe, and Brazil.

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- [DoceboLMS](#) features a unique LMS design that makes it easy to train employees, partners, and customers worldwide. It is an online training platform to organize, track and distribute courses for formal learning. It supports multiple formats including xAPI, SCORM and AICC and has been developed by [Docebo Company](#).
- [eCollege](#) is an on-demand, or software as a service (SaaS), provider of eLearning software and services to secondary and post-secondary learning institutions and is owned by [Pearson PLC](#). eCollege was founded in 1996 as Real Education, the company went public in 1999 as eCollege.com.
- [Edmodo](#) is a cloud-based LMS, developed by global education network [Edmodo](#) that allows for collaborative learning through content sharing, communication tools, and classroom management. It offers unlimited storage for content, which means administrators spend less time dealing with paperwork.
- [EduNxt](#) is the next generation learning system that fully takes advantage of modern teaching techniques to create a virtual classroom where students come together to learn from distinguished faculty and each other. EduNxt makes it possible for students to collaborate on team-oriented learning tasks like assignments and case studies through audio, visual and IM aids. It has been developed by the [Sikkim Manipal University](#).
- [eFront](#) is an eLearning platform, which has historically been coming in a number of editions, from an open-source edition to the latest eFrontPro edition (which is the only available one in 2018). eFront is designed to assist with the creation of online learning communities while offering various opportunities for collaboration and interaction through an icon-based user interface. The platform offers tools for content creation, tests building, assignments management, reporting, internal messaging, forum, chat, surveys, calendar and others. It has been developed by the [Epignosis](#) is a leading technology vendor.
- [Engrade](#) is an educational technology company that provides online learning management system and educational assessment products to K-12 school districts. Engrade was founded in 2003 and later acquired by [McGraw-Hill Education](#) in January 2014.
- [EthosCE](#) is a learning management system for the administration of continuing medical education in nursing, pharmacy and other healthcare-related programs. Developed by [DLC Solutions](#), it provides interfaces for organizations to produce and manage continuing education websites. Distribution is provided as a software-as-a-service web application.
- [GlobalScholar](#) is an operating unit of Scantron based in Bellevue, Washington which develop, manufacture, license, and support a wide range of products and services related to education. This includes products such as an enterprise resource planning (ERP) software, Pinnacle Suite, which supportes all aspects of managing education at K-12 schools, including a gradebook, learning management system (LMS), and teacher development, analytics and online learning. It has been developed by [Crunchbase Enterprise](#).
- [Glow \(Scottish Schools National Intranet\)](#) is a major national ICT and telecommunications programme managed by [Education Scotland](#). The funding for Glow came from the Scottish

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Government and the project is a collaboration between local authorities, Education Scotland and RM Education.

- [Google Classroom](#) is a free web service, developed by [Google](#) for schools, that aims to simplify creating, distributing, and grading assignments in a paperless way. The primary purpose of Google Classroom is to streamline the process of sharing files between teachers and students. Google Classroom combines Google Drive for assignment creation and distribution, Google Docs, Sheets and Slides for writing, Gmail for communication, and Google Calendar for scheduling. Students can be invited to join a class through a private code, or automatically imported from a school domain.
- [Grovo](#) is a New York City-based technology company that provides a SaaS learning platform to improve and advance employee and organizational performance. Grovo provides companies with a software-as-a-service learning platform and it refers to its approach as microlearning – 144-second video and audio lessons interspersed with short quizzes and practice assignments. In November 2018, Grovo was acquired by [Cornerstone OnDemand](#).
- [Growth Engineering](#) is a platform for e-Learning, also known as a learning management system. It offers a learning portal for companies and their employees, partners and customers. It has been developed by [Growth Engineering](#), which is a SAAS learning technologies company.
- [Halogen Software](#) is a Canadian company that provides cloud-based talent management solutions to customers with between 100 and 10,000 employees. It's parent company is [Saba Software Inc.](#)
- [HotChalk](#) is a learning environment for K-12 teachers, students and parents that includes a learning management system (LMS), a library of teacher-contributed lesson plans, premium digital content, and professional development for teachers in a Web-based environment. It is available through any Internet browser, the HotChalk Learning Environment is an easy to use system and brings teachers, students and parents together to improve education. In August 2007, McGraw-Hill partnered with [HotChalk](#) education technology company to make McGraw-Hill training and certification tools available to HotChalk users.
- [ILIAS](#) (Integriertes Lern-, Informations- und Arbeitskooperations-System – which is the German name for "Integrated Learning, Information and Work Cooperation System") is an open-source web-based learning management system. It supports learning content management (including SCORM 2004 compliance) and tools for collaboration, communication, evaluation and assessment. It has been developed by [ILIAS open source e-Learning e. V.](#)
- [Inquisiq R3](#) is a web-based SCORM compliant Learning Management System (LMS) that is owned by [ICS Learning Group Inc.](#) Inquisiq R4 is used for delivering and tracking both e-learning courseware and traditional training. The product is available as either a Software-as-a-Service (SaaS) model or an unlimited user on-premises model hosted by the customer or the vendor.
- [itslearning](#) is a digital learning management system developed by the Norwegian company [itslearning AS](#). It is designed for both K12 and higher education.

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- [Kannu](#) is a learning management system, purpose-built for creative education in music, arts, and design. It was released by California-based company [Kadenze Inc.](#) ("Kadenze") in 2014 after the success of its MOOC platform.
- [LAMS](#), the Learning Activity Management System, is an open source Learning Design system for designing, managing and delivering online collaborative learning activities. It provides teachers with a visual authoring environment for creating sequences of learning activities. These activities can include a range of individual tasks, small group work and whole class activities based on both content and collaboration. LAMS is „inspired“ by the concept and principles of IMS Learning Design. LAMS is developed in collaboration with [LAMS Foundation](#) and a number of educational institutions around the world.
- [LearningCart](#) is a US-based all in one learning management platform that enables users to sell training modules, digital files, physical products, in person events and webinars. LearningCart lets users track sales, customers, view course progress, and build reports. It is also compatible with Google Analytics. LearningCart has been developed by the homonymous „[LearningCart Company](#)“.
- [LON-CAPA](#) (Learning Online Network with Computer-Assisted Personalized Approach) is an e-learning platform, also known as a Course Management System. It possesses the standard features of many learning platforms (user roles, calendar, e-mail, chat rooms, blogs, resource construction and test grading), but it differs from traditional e-learning platforms in that its many web servers (in various parts of the world) can communicate with each other. It has been developed by the [Michigan State University](#).
- [Moodle](#) is a free and open-source learning management system (LMS) written in PHP and distributed under the GNU General Public License. Developed on pedagogical principles, Moodle is used for blended learning, distance education, flipped classroom and other e-learning projects in schools, universities, workplaces and other sectors. With customizable management features, it is used to create private websites with online courses for educators and trainers to achieve learning goals. Moodle (acronym for modular object-oriented dynamic learning environment) allows for extending and tailoring learning environments using community-sourced plugins. The company that drives development of Moodle is [Moodle Pty Ltd](#) founded by Martin Dougiamas.
- [OLAT](#) is an acronym for Online Learning And Training. It is a web application – a so-called Learning Management System that supports any kind of online learning, teaching, and tutoring with few educational restrictions. OLAT is free software and is open-source. Its development started in 1999 at the [University of Zürich](#).
- [Open edX](#) is the open-source platform software developed by [EdX](#) and made freely available to other institutions of higher learning that want to make similar offerings. On June 1, 2013, edX open sourced its entire platform.
- [OpenOLAT](#) is a web-based learning management system for teaching, education, assessment and communication. The name OpenOLAT stands for Open Online Learning And Training, highlighting its open source and online nature. OpenOLAT is based on the LMS OLAT developed by the [University of Zürich](#).

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- [Sakai](#) is a free, community source, educational software platform designed to support teaching, research and collaboration. Sakai is developed by a community of academic institutions, commercial organizations and individuals. It is distributed under the Educational Community License (a type of open source license). The development of Sakai was originally funded by a grant from the [Mellon Foundation](#) as the „Sakai Project“.
- [SAP](#) is an enterprise resource planning software developed by the German company [SAP SE](#). SAP ERP incorporates the key business functions of an organization. The latest version of SAP ERP (V.6.0) was made available in 2006. The most recent Enhancement Package (EHP8) for SAP ERP 6.0 was released in 2016.
- [Schoology](#) is a social networking service and virtual learning environment for K-12 school and higher education institutions that allows users to create, manage, and share academic content. This cloud-based platform provides tools needed to manage an online classroom. Schoology can help teachers contact students with homework and more. They can post daily reminders or updates. They can message students, manage the assignment calendar and put new assignments. The [Schoology Company](#) was founded by four (4) college students, Jeremy Friedman, Ryan Hwang, Tim Trinidad, and Bill Kindler.
- [Skillsoft](#) is a learning management system produced by the homonymous American „[Skillsoft](#)“ educational technology company, founded by Charles Moran in 1998. Skillsoft Company simplifies policy and procedural workflows, assesses knowledge and certifies communications, while maintaining an auditable track to ensure compliance.
- [Spongelab](#) is a science education website for teachers and students created by [Spongelab Interactive](#). The website provides a free online collection of multimedia including educational games, videos, images, and lesson plans, with a focus on game-based learning. Spongelab is a web-based teaching platform that allows educators to combine science, discovery learning tools and technology to create a visually engaging interactive whole.
- [SuccessFactors](#) is an American multinational company headquartered in South San Francisco, California, providing cloud-based software for human capital management using the Software as a service (SaaS) model. SuccessFactors was founded in 2001 by Lars Dalgaard. In November 2007, the company went public on the [NASDAQ](#) Global Market under the stock symbol SFSF.
- [SumTotal Systems](#) is a software company based in Gainesville, Florida that provides human resource management software and services to private and public sector organizations. The company uses multiple cloud-based channels, including Software as a Service (SaaS), Hosted Subscription, and premises-based licensure. In September 2014, SumTotal was acquired by [SkillSoft](#), a provider of online learning to corporate training organizations.
- [SWAD](#) (originally stood for "Sistema Web de Apoyo a la Docencia" in Spanish or "Web System for Education Support", currently stands for "Shared Workspace At a Distance") is a web application to manage the courses, students and teachers of one or more educational institutions. It has been developed by the [SWAD development team](#).
- [Taleo](#) was a publicly traded database vendor based in Dublin, California. Taleo's product offerings primarily focus on talent acquisition (recruitment), performance management, learning

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and development, and compensation management. These capabilities combine to provide what Taleo calls "Talent Intelligence" - an enhanced level of insight into candidates and employees. Its owner is [Oracle Corporation](#).

- [Totara Learn](#) is a flexible, open learning management system (LMS) that gives organisations the freedom to learn. As an open source learning platform, Totara Learn is fully customisable, enabling anyone to make it his/her own. Anyone is free to integrate and extend to suit his/her timescale and business needs. It has been developed by the homonymous [Totara Company](#).
- [Udutu](#) is an SAAS platform for e-learning, and is based in Victoria, British Columbia. The company's Udutu LMS product is used for employee training, customer training, channel training, and compliance training. Udutu also offers a course authoring tool and a PowerPoint to HTML5 converter for SCORM compatibility. Udutu's LMS and Course Authoring Tool were developed out of a [Royal Roads University](#) (RRU) initiative started in 1995.
- [Uzity](#) is a virtual learning environment and course management system developed by [Foradian Technologies](#). It is a collaboration platform for students, teachers, administrators and management of an institution. Uzity assists in knowledge management of the entire institution and functions as a repository of course, information and collaboration data. It is developed by the same team who developed Fedena. Uzity assists teachers and students to collaborate and learn the contents of different courses. Students can ask questions specific to each topic and the answers can be given by a teacher or other students. It allows the uploading of learning resources about different topics in a course and enables sharing of the resources to other courses in the same organization. Uzity gives full control of designing and implementing the learning activities of an institution.
- [WeBWork](#) is an online homework delivery system primarily used for mathematics and science. It allows students to complete their homework over the web, and receive instantaneous feedback as to the correctness of their responses. WeBWork uses a Perl-based language called PG to specify exercises which allows instructors a great deal of flexibility in how exercises are presented. WeBWork was originally developed at the [University of Rochester](#) by professors Michael Gage, and Arnold Pizer.
- [WizIQ](#) is a cloud based education platform to access teaching and training modules through smartphones and laptops. The parent company that owns the specific cloud based education platform is [authorGEN Technologies Pvt. Ltd.](#)

3. Survey of current LMSs most widely used

As shown in the previous section, there are many systems available to provide distance education (DE) and manage it. Because of this and with the aim of increasing the output of the present project a questionnaire has been developed (see Appendix) and sent to all partners of the InSIDE project. This extra knowledge adds an important layer of relevance to the decision making process for the

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LMS and allows optimizing the efforts required to bootstrap the infrastructure and the processes that are going to be designed and developed.

We received 10 valid answers. Questions made and answers collected are shown below.

1. What is the official language in your institution? (by frequency, descendant)
 - 1.1. French
 - 1.2. Arabic
 - 1.3. English
 - 1.4. Greek
 - 1.5. German

2. Is DE available at all in your institution?
 - Yes, 9 of 10

3. At what level does your institution provide DE? (by frequency, descendant)
 - 3.1. Internal purpose
 - 3.2. Continuing education & master programs
 - 3.3. Bachelor programs & postgraduate education

4. Estimate the ratio of courses at your institution that is provided as DE
 - <<, 8 of 10
 - 20%, 2 of 10

5. In what languages does your institution provide DE courses? (by frequency, descendant)
 - 5.1. Arabic
 - 5.2. French
 - 5.3. English
 - 5.4. Greek
 - 5.5. German

6. Which software are you using for providing DE services now?
 - Moodle 10 of 10
 - Big Blue Button 2 of 10
 - Google Classroom 2 of 10
 - edX 1 of 10
 - WizIQ 1 of 10

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7. What features are crucial for a successful DE platform? (by frequency, descendant)
 - 7.1. File repository and video
 - 7.2. Administration
 - 7.3. Forum, chat and free cost for student
 - 7.4. Audio, task & marks, open to students and free cost for provider

8. Is your institution part of any DE network, pool or initiative?
 - No, 10 of 10

9. Does your institution have services for students with disabilities?
 - Yes, 8 of 10

10. Are students with disabilities studying in your institution? (by frequency, descendant)
 - 10.1. Mobility disabled
 - 10.2. Blind and VIP
 - 10.3. HoH
 - 10.4. Deaf
 - 10.5. Other disability

Based on the analysis of the answers received, Moodle turned out to be the best candidate for our project as according infrastructures, know-how and experiences are in place at partners' institutions. This last one is of capital importance, the existing state of the art at partner universities is important for the sustainable success of the project. Other candidates should be considered and analysed due to the small sample and in particular, regarding accessibility support, this is the main reason for the following description and comparative sections.

4. Description of selected LMSs

The selection of LMSs for the comparison has been made using the answers collected for the survey presented in the previous section, as well as on the basic requirements identified and defined during partner meetings. These requirements are first related to the need of customization to meet the accessibility demands, which are key to this project:

- Free software
- Full functional LMS
- Self-hosted in an owned IT infrastructure.

Finally, the selection for the comparative analysis includes seven LMSs

1. Moodle
2. edX
3. aTutor
4. Chamilo
5. Totara Learn

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6. Canvas
7. Edmodo

The reason for this selection is that Big Blue Button, Google Classroom and WizIQ do not meet the outlined requirements. In addition, it is considered worth to include a LMS designed with accessibility in mind from its start, what is the case with aTutor. Below, the seven candidates are described and their strengths and drawbacks are highlighted by focusing on: teaching tools available, communication mechanisms, authoring tools, analytics, administration, accessibility and usability, interoperability and ease for customization.

4.1. Moodle

Website: <https://moodle.org>

Community: <https://moodle.org/course/index.php>

Accessibility: <https://docs.moodle.org/dev/Accessibility>
<http://collaborate.athenpro.org/group/moodle>

This is the most popular open-source web-based LMS, used to create online learning sites. It provides basic tools for offering user friendly and flexible high quality learning. There are an extensive documentation for instructors. Furthermore, developers and administrators have well established community with active forums, sharing tips and sharing resources that provide support for security, administration and development works. It is an internationalised and well-tested software having thousands of instances running worldwide in more than 75 languages [1].

Moodle's modular design is to be underlined in particular what together with its open-source nature shows a very flexible and effective customizability. It is organised around so-called virtual learning environments, which focus on communication, what occupies the most relevant spaces in the system trying to improve the engagement and to add more quality to the learning process. Its modular conception allows having a repository of modules developed by the community that extend the functionality of any implementation. This adds a great value to the whole project. An example for this is the functionality of adding subtitles to videos, which is not included by default. Somebody develop it as a module and adds it to the module repository what makes it available to the whole community.

Accessibility it taken into account in Moodle. There is a section for this in documentation [2] and a community [2] dedicated entirely to this mater. Although Moodle is a highly customizable and flexible platform it is not possible to assure that all instances of Moodle are accessible or comply with accessibility standards. Accessibility depends on individual customizations and active modules in each instance. Nevertheless, the development of the core is committed to follow the main accessibility standards and guidelines. Moodle can be described as ready for accessibility with good support for those setting up the infrastructure, managing the process and developing content [2].

Teaching tools:

- Type of learning supported:
 - Self-paced
 - Instructor-led

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- Blended learning
- Gradebook
- Calendar
- Multilanguage
- Multimedia embedding (Audio, video and interactive content)[3]
- Quizzes
- Pools
- Assignments
- Wiki
- Blog

Communication:

- Forum
- Chat
- Wikis
- Video conferencing (plug-in) [4]
- Workgroup

Authoring tools:

- Built-in authoring tool
- Course creation and modification
- File repository
- Editor for:
 - Text
 - HTML
 - Equations

Analytics [5]:

- Implements an analytics suite that use machine learning to predict and detect unknown aspects of the learning process.
- Notifications with custom triggers.
- Reports available by default:
 - Student progress
 - Assignment
 - Participation
 - Activity monitoring

Administration:

- Tools for managing:
 - Plugins
 - User roles
 - Enrolment
 - Multilanguage settings
 - Uploads
 - Site and server

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- Security
- Reports for administrators:
 - Changes
 - Course overview
 - Activities
 - Questions made
 - Comments
 - Backups
 - Logs and live logs
 - Performance
 - Security

Accessibility:

- Guidelines followed:
 - W3C WCAG 2.0
 - W3C ATAG 2.0
 - W3C ARIA 1.0
 - Section 508
 - European Accessibility Act
- Accessibility checker in editor.

Interoperability [6]:

- IMS LTI™ Certified
 - IMS Common Cartridge
- SCORM-ADL compliant
 - SCORM 1.2
- Open Badges
- LDAP authentication
- RSS

Customization:

- It is open-source
- The architecture is modular based on plugins that can be modified.
- There are a repository of plugins available for download [7].
- Server side is mainly developed using PHP.

4.2. edX

Website: <https://open.edx.org>

Community: <https://open.edx.org/community>

Accessibility: <https://www.edx.org/accessibility>

edX is created by edX Inc. a non-profit organization founded by Massachusetts Institute of Technology and Harvard University in 2012. It maintains an online platform for MOOCs which

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became the second largest in the world [8]. This institution develops the MOOC platform under open-source license. It is called Open edX and it is freely available for both use and modification/extension. Because of the requirements of this project, Open edX got analyzed [9, 10]. The software architecture is modular which allow an easy and fast customization and courses design. xBlocks are modules which are stored and organized in a repository for their download and use for instances and courses that they might need them as extra/extended features.

In the same way as Moodle, the design and development of Open edX consider accessibility. In comparison to Moodle, the support for setting up accessible infrastructures and developing content seems to be lower as no active community forum could be identified. The development resources related to accessibility were documents [11] and a wiki [12].

Teaching tools:

- Type of learning supported:
 - Self-paced
 - Instructor-led
 - Virtual classroom
 - Blended learning
- Gradebook
- Multilanguage
- Video in HD, animations and augmented reality.
- Adaptive learning that allows dynamic course content and assessments.
- Gamification
 - Badges
 - Levels

Communication:

- Forum
- Chat
- Video conferencing
- File sharing
- Workgroup

Authoring tools:

- “Open edX Studio” is called the authoring tool that allows [9]:
- Create courses
 - Schedule
 - Course members with different roles
 - Grading policy
- Modification of course before and after it starts

Analytics:

- Built-in tool called “Open edX Insights” for this purpose, that offer students activity and progress and custom report making.
- It allows export reports of courses in CSV.
- Reports available by default:

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- Grade audit
- Enrolment
- Students
- Issued certificates
- Support issues

Administration:

- It is organized in microsites which are subdomains that contains different courses [13]. (It allow “campus” implementation)
- System live logs
- Email notifications
- Registration limitation to specific domains

Accessibility:

- W3C WCAG 2.0
- Responsive web interface.

Interoperability:

- OLX (Open Learning XML) [14] is a version of XML to allow sharing courses between different instances.
- IMS Global LTI 1.1.1
- Third-party tool to enable xAPI/Tin Can content [14].
- Third-party tool to enable SCORM content [14]. (It is necessary package content into a LTI compatible module with a third-party tool.)

Customization:

- It is open-source and there are a new release each 6 months [15].
- It has a modular architecture that allows scale.
- Server side is mainly developed using the framework Django (Python).
- It uses extensible modules and themes to customize the user interface, being possible an easy customization with the addition of those modules. On the other hand, it enables development of modules for a more depth personalization.
- There are open source desktop and mobile application for iOS and Android to access to the courses [16].

4.3. aTutor

Website: <https://atutor.github.io>

Community: -

Accessibility: https://atutor.github.io/atutor/docs/atutor_accessibility.html

aTutor is an open-source web-based LMS used to develop and deliver accessible online courses. It was released in 2002 with the aim of providing a LMS accessible to people with disabilities by

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complying with the main accessibility guidelines. Although the lead developer stepped down in 2018, the community continues the development and maintenance of the project [17].

Due to its origin in the accessibility community, we can expect accessibility of the platform and support for setting up the infrastructure and developing content at highest level. The major constraint is the low number of installations in use and following this a small size of the community for adding new features and functionalities and providing support, what is seen as its major drawback.

Main features [18] are described below:

Teaching tools:

- Type of learning supported:
 - Self-paced
 - Instructor-led
- Multilanguage
- Video in HD, animations and augmented reality.
- Latex
- Reading lists
- Pools
- Gamification

Communication:

- Internal email
- Forum
- Chat
- Blogs
- File sharing
- Workgroups

Authoring tools:

- Content editor
- Visual editor WYSIWYG

Analytics:

- Content usage
- Student progress

Administration:

- Courses
- Modules
- Tests
- Workgroups
- Enrolments
- Users

Accessibility [19]:

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- W3C XHTML 1.0
- W3C WCAG 2.0
- W3C ATAG 2.0
- IMS AccessForAll 2.0
- ISO/IEC 24751
- Section 508
- Stanca Act
- Accessibility checker in editor tool.
- Adaptive navigation that enable that the presentation of the environment could be customized by users.

Interoperability:

- IMS Content Packaging 1.1.2+
- SCORM Content Packaging
- SCORM 1.2 LMS RTE3
- IMS Question Test Interoperability (QTI) 1.2/2.1
- IMS LTI 1.0
- IMS Common Cartridge 1.0
- OpenSocial 1.0
- OAuth Authentication Protocol

Customization:

- Add-on Modules that allow external search engines, RSS, Open Meeting, etc.

4.4. Chamilo

Website: <https://chamilo.org/en/>

Community: <https://forum.chamilo.org/>

Accessibility: <https://chamilo.org/en/2018/09/18/elearning-and-accessibility-part-i/>

Chamilo is a Learning Management System (LMS) that enables you to create a virtual campus for online and semi-online training.

Chamilo has been developed as an open-source solution with GNU/GPLv3 license and is protected by a non-profit organization. Currently, it is being utilized by more than 500,000 users across various age groups in over 25 countries.

Chamilo is a free e-LMS that is designed for ease of use and speed. Its key features include courses catalog, skills management, certificates generation, configurations of complex configurations, and SCORM support. Plus, it offers a shopping cart to help you sell your e-learning courses and make money. This solution accommodates over 3,000 simultaneous connected learners. Other main advantages include cloud compatibility, high availability, and quick resolution of security flaws.

With Chamilo, you can effortlessly create training content, install Web hosting solutions for free, track students' results, improve learning methodologies, use the neat interface to focus on learning,

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utilize both synchronous and asynchronous communication channels, use practical, auditive, and visual e-learning tools as well as staff selection and serious games, benefit from the range of document management features, manage users, courses, and training cycles, utilize SOAP Web services for remote management, and finally, conduct time-controlled exams [20].

Teaching tools [21]:

- Type of learning supported:
 - Asynchronous Self-paced
 - Asynchronous Instructor-led
 - Synchronous Virtual Classroom
 - Blended Learning
- Multilanguage
- Gradebook
- Gradebook audit trail
- Multiple grading scales
- Manual Grading ("Marking")
- Course History
- Shared calendar
- Wiki
- Glossary
- Agenda
- Video in HD, animations and augmented reality.
- Gamification
 - Badges
 - Badge customization
 - Points
 - Rewards
 - Leaderboards

Communication [21]:

- Internal email
- Forum
- Chat
- Blogs
- Documents sharing (Dropbox)
- Working groups
- Social learning network [22]
 - Mark friends
 - Form or join interest groups
 - Publish your portfolio
 - Link to your blog's last post (or any RSS feed)
 - Publish links to your other social networks profiles

Authoring tools [21]:

- Built-In Authoring Tool

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- Changing Course default settings
- Upload courses
- Can reuse PPTs, PDFs, Videos
- Consume online video content
- Tests Engine
- Survey Engine
- Assignments Engine
- Course backup Options

Analytics [21]:

- Reports
 - Grading Report Settings
 - Exporting Reports in variety of formats
 - Canned Reports
 - Dashboards and Graphic Reports

Administration [21]:

- Courses
- Modules
- Tests
- Working groups
- Enrolments
- Users
- Uploads

Accessibility [22]:

- WCAG/WAI accessibility standard support

Interoperability [22]:

- LDAP/ActiveDirectory connector available
- CAS connector available
- Shibboleth connector available
- OpenID connector available
- Drupal connector available
- Joomla connector available
- Oracle connector available (through modified SOAP)

Customization [22]:

- Extensible through plugins
- Open Source (GNU/GPLv3 license and compatible licenses for components)
- Editable document templates (allowing for the use of a common branding in newly created documents)
- Editable homepage
- Editable registration page.

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4.5. Totara Learn

Website: <https://www.totaralearning.com/>

Community: <https://www.totaralearning.com/community/totara-community>

Accessibility: <https://help.totaralearning.com/display/TPD/Totara+Learn+Accessibility>

Totara Learn is a tool whose mission is to revolutionize how educational tools are built, delivered and acquired. Its developers are convinced that we are living in a constantly changing world. In order to be successful, Totara understands that there is a constant demand to learn new abilities, knowledge, and even behaviors. Companies thus need to adapt to keep in front. Thus, having the freedom to adapt to the times is essential. It does not have license fees. Totara software is highly versatile, open source, and is implemented in a wide range of sectors and organizations [23].

Teaching tools [24]:

- Type of learning supported:
 - Asynchronous Self-paced
 - Asynchronous Instructor-led
 - Blended Learning
- Multilanguage
- Gradebook
- Gradebook audit trail
- Multiple grading scales
- Manual Grading ("Marking")
- Course History
- Calendar
- Video in HD, animations and augmented reality.
- Gamification
 - Badges
 - Badge customization
 - Leaderboards

Communication [25]:

- Internal email
- Portfolios
- Messaging
- RSS Feeds
- Blogs

Authoring tools [24]:

- Built-In Authoring Tool
- Changing Course default settings
- Upload courses
- Can reuse PPTs, PDFs, Videos
- Consume online video content

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- Tests Engine
- Survey Engine
- Assignments Engine
- Course backup Options
- Scheduling LIVE events
- Learning Paths (Curriculums)

Analytics [24]:

- Reports
 - Grading Report Settings
 - Training Record Maintenance
 - Exporting Reports in variety of formats
 - Canned Reports
 - Automated Report Scheduling
 - Email delivery of Reports
 - Dashboards and Graphic Reports

Administration [24]:

- Courses
- Modules
- Enrolments
- Users
- Uploads

Accessibility [26]:

- VPAT for Totara Learn

Interoperability [25]:

- External Tool feature

Customization [25]:

- Extensible through plugins
- Experimental
- XMLDB Editor
- Debugging
- Web Service Test Client
- Purge All Caches
- Unit Tests.

4.6. Canvas

Website: <https://www.instructure.com/canvas/>

Community: <https://community.canvaslms.com/>

Accessibility: <https://community.canvaslms.com/docs/DOC-2061-accessibility-within-canvas>

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Canvas is considered to be the fastest-growing LMS today. This open-source LMS by Instructure Inc. helps you scale your best curricula and instruction with easy-to-use and customizable teaching & learning experience. Students and teachers alike are empowered by making an engaging learning environment available to them.

This open-sourced cloud-based application includes learning tools that cultivate teachers and learners. The Canvas Studio allows teachers to engage their students with video-based learning and collaboration tool. Teacher development can also be accelerated using Canvas Practice which is an interactive video platform complete with peer/expert feedback and self-reflection features. The MasteryPaths feature helps differentiate students' learning pathways more efficiently. All of these and more are provided by a full suite of mobile user apps for true mobile learning and teaching experiences.

Canvas is integrated student information systems, video platforms, professional development platforms, content management systems and so much more. Thanks to its open infrastructure, it can scale with your needs.

The platform is available for desktops as well as on mobile. The platform is available on Apple, Microsoft, or Linux operating systems. Because creating a true and engaging educational experience varies from person to person and from institution to institution, Canvas LMS is offered via custom quote-based plans [27].

Teaching tools [28]:

- Type of learning supported:
 - Asynchronous Self-paced
 - Synchronous Virtual Classroom
- Gradebook
- Calendar
- Video in HD, animations and augmented reality.
- Gamification
 - Badges
 - Points
 - Rewards
 - Levels

Communication [28]:

- Internal email
- Chat
- Documents sharing
- Student Groups [30]

Authoring tools [28]:

- Built-In Authoring Tool
- Changing Course default settings
- Upload courses
- Can reuse PPTs, PDFs, Videos
- Consume online video content

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- Tests Engine
- Assignments Engine
- Scheduling LIVE events

Analytics [28]:

- Reports
 - Grading Report Settings

Administration [28]:

- Courses
- Modules
- Users
- Uploads

Accessibility [29]:

- Screen Readers and Browsers
 - VoiceOver
 - JAWS
 - NVDA
- Moving Content within Canvas
- Keyboard Shortcuts
- Accessibility within Specific Canvas Features
 - Font Sizing
 - Rich Content Editor
 - Calendar
 - Quizzes
 - Gradebook
 - User Settings
 - Chat tool
 - SpeedGrader/DocViewer/Annotations
 - LTI Integrations
 - Styled & Accessible Learning Service Agreements (SALSA)
 - Universal Design Online content Inspection Tool (UDOIT)

Interoperability [28]:

- Google Docs [30]
- External Tool feature

Customization [28]:

- Extensible through plugins
- Canvas .html Style Guide [30].

4.7. Edmodo

Website: <https://new.edmodo.com/?go2url=%2Fhome>

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Community: <https://go.edmodo.com/community/>

Accessibility: <https://spotlight.edmodo.com/product/edmodo-accessibility--399381/>

Edmodo covers most of the basic features of LMSs, but it is also similar to Social Learning Networks (SLN) in terms of structure and functioning. Edmodo provides opportunities offered by Social Learning Services (SLS) allowing free sharing of content; in addition, it also includes such features found in LMSs as a course planning tool, and homework, examination, and questionnaire applications.

It was founded in Chicago, Illinois, and was designed to herd education into the 21st century. Today, Edmodo is based in San Mateo, California. It has become one of the leading K-12 social learning networks in the world, resolved to connecting all students with the instructions and people they need to maximize their full potential.

In addition to modernizing the way educators interact with students, Edmodo also allows them to engage students throughout each class. Using this platform, you will get access to all the tools you need to give your students a more exciting learning experience. Other than helping you facilitate online classroom discussions, this software also has great gamification tools that can help you motivate your students to participate more [31].

Teaching tools [32]:

- Type of learning supported:
 - Blended Learning
 - Mobile Learning [33]
- Gradebook
- Calendar
- Video in HD, animations and augmented reality.
- Gamification
 - Badges

Communication [33]:

- Discussion Forum
- Asynchronous document sharing
- Blogs

Authoring tools [32]:

- Can reuse PPTs, PDFs, Videos
- Tests Engine
- Assignments Engine
- Scheduling LIVE events

Analytics [32]:

- Reports
 - Dashboards and Graphic Reports
 - Training Record Maintenance

Administration [32]:

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- Users
- Uploads [33]

Accessibility [34]:

- Text enlargement
- Screen enlargement
- Keyboard Shortcuts
- Accessible via mobile browser (m.edmodo.com) [33]

Interoperability [35]:

- Google Drive / Google Docs

Customization [32]:

- Personalized views.

5. Potential use for PwSN

DE is more flexible than traditional in-site teaching methods. There is no need of people's transport and PwSN can easily set up their place area according to their personal preferences. A full personalised environment in which they are able to receive education, make the learning process more effective. On the other hand, DE provides something that is not available in the traditional education. Distance courses which are developed with Universal Design for Learning (UDL) standards, apart of being accessible because information is presented in a proper and multiple ways, promote inclusion. This fact not only improves the learning performance of PwSP, but makes feel them more useful and integrated into the community.

Focusing on the described LMS, usability for people with special needs, varies greatly from one to other. It is noticeable that there is a correlation between the level of awareness, about inclusion, that the project behind each LMS shows and the level of accessibility it has. aTutor is an exception to this but, it could be explained by it was born with the aim of provide DE specifically to people with special needs. But, the rest vast majority of LMS shows this correlation.

However, most of LMS are suitable for providing DE to people with special needs. With Moodle, edX and aTutor is possible to deliver an accessible education that is compatible with the most widespread Assistive Technology (AT). But, aTutor does not offer the level of inclusive education that others show. This is due, the special and non-common design of aTutor. Many features that others DE systems pack by default are not included in aTutor. People who do not have any of the special needs of ViHeMo may feel this lack of features, making them prefer other options.

The assurance of accessibility at all levels, framework, deployment and content creation, have to be done in order to provide a final accessible education. Involved personal for all three levels have to be trained in providing accessible education and standards and guidelines related to accessibility have to be followed equally in the three alternatives (Moodle, edX and aTutor). It is important to notice that students that take courses from those different systems have to have available the suitable AT for them.

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Other alternatives like Google Classroom could meet most of the accessibility requirements that PwSN could have. And in the latest times these chances have raise due the efforts of Google is making to produce accessible solutions. Concering WizIQ, PwSN is expected to have trouble to use it due to the lack of accessibility support of this DE system. It is worth to point out that these two alternatives as they are SaaS based, it is not possible to make changes and modifications in order to meet the accessibility issues that could arise. The source code is closed and the service is provided from a private server.

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Appendix

I. Questionnaire sent to partners of the InSIDE project

1. What is the official language in your institution? (options)
 - 1.1. French
 - 1.2. Arabic
 - 1.3. English
 - 1.4. Other
2. Is distance education available at all in your institution? (Yes / no)
3. At what level does your institution provide Distance Education? (multi-option)
 - 3.1. For internal purposes and / or single activities / courses only
 - 3.2. For continuing education or university preparation courses
 - 3.3. For Bachelor programmes
 - 3.4. For Master programmes
 - 3.5. For Postgraduate Education
 - 3.6. For something different
4. Estimate the ratio of courses at your institution that is provided as DE. (percentage)
5. In what languages does your institution provide DE courses? (multi-option)
 - 5.1. Arabic
 - 5.2. French
 - 5.3. English
 - 5.4. Other

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6. Which software are you using for providing DE services now? (multi-option)

- | | |
|---|--------------------------------------|
| 6.1. Alefbet | 6.32. Learning.ly |
| 6.2. ALT on Moodle platform | 6.33. Mahara |
| 6.3. AtoCC | 6.34. Metacoön |
| 6.4. Blackboard | 6.35. MiríadaX |
| 6.5. Canvas Network | 6.36. MIT Media Lab |
| 6.6. Chamilo | 6.37. Moodle |
| 6.7. Claroline | 6.38. Mookit |
| 6.8. Code.org | 6.39. NovoEd |
| 6.9. Colobot | 6.40. NPTEL |
| 6.10. CommSy | 6.41. OLAT |
| 6.11. Coursera | 6.42. OPAL (platform) |
| 6.12. Curriculum Pathways | 6.43. Open Roberta |
| 6.13. Desire2Learn (D2L) | 6.44. OpenCourseWorld |
| 6.14. Docebo | 6.45. OpenHPI |
| 6.15. Dokeos | 6.46. OpenOLAT |
| 6.16. DotLRN | 6.47. Philanthropy University |
| 6.17. Edmodo | 6.48. PLATO (computer system) |
| 6.18. edX | 6.49. QualiboXX |
| 6.19. Eliademy | 6.50. Sakai (Software) |
| 6.20. Flooved | 6.51. SchulLV |
| 6.21. France université numérique (FUN) | 6.52. Scoyo |
| 6.22. Future Learn | 6.53. Scratch (Programming language) |
| 6.23. Google (based on Course Builder) | 6.54. Serlo |
| 6.24. Google Expeditions | 6.55. Simpleclub |
| 6.25. ILIAS (Software) | 6.56. Snap! (BYOB) |
| 6.26. IServ | 6.57. Stud.IP |
| 6.27. Itslearning | 6.58. Udacity |
| 6.28. iTunes University | 6.59. Udemy |
| 6.29. Iversity | 6.60. Wikiversity |
| 6.30. Kadenze | 6.61. Wiziq |
| 6.31. Khan Academy | 6.62. Other |

7. What features are - from your point of view, crucial for a successful distance education platform? (multi-option)
 - 7.1. Administration of Students
 - 7.2. Audio
 - 7.3. Chat functionality
 - 7.4. File repository
 - 7.5. Forum functionality
 - 7.6. Free of cost for providers
 - 7.7. Free of cost for students
 - 7.8. Open to all (public)
 - 7.9. Open to members / participants
 - 7.10. Progress reports
 - 7.11. Task and mark functions
 - 7.12. Video
 - 7.13. Others
 - 7.14. I don't know
8. Is your institution part of any DE network, pool or initiative? (text)
9. Does your institution have services for students with disabilities? (Yes / no)
10. Are students with disabilities studying in your institution? (multi-option)
 - 10.1. No.
 - 10.2. Yes, partially sighted students
 - 10.3. Yes, blind students
 - 10.4. Yes, hard of hearing students
 - 10.5. Yes, deaf students
 - 10.6. Yes, students with mobility disability
 - 10.7. Yes, students with other disability
 - 10.8. Yes, other form of disability
 - 10.9. Yes, most of the above, but only in Distance Education Courses