



e-Hoop - Unified e-Hoop Approach to Learning Differences

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1. Aim of this document

The current document belongs conceptually to the deliverables of WP2 which will provide the input for development of the sample training content and delivery tools in WP3 and WP4. More specifically, the current document is part of the activities to be carried out in the context of Task T2.1 – Analysis of current situation.

The foreseen activities & deliverables under task T2.1 are:

- D2.1 – 5 Country Reports on Obstacles to an ideal educational institution - Digital Reports.
- D2.3 - Report and on-line database of existing FLOSS tools supporting personalised learning.
- D2.4 - Definition of the top ten reasons for educators and top ten reasons for learners for using the platform.

The activities of WP2 start with the identification of the **current state-of-play** through the elaboration of the five country reports (D2.1), one for each country of the partnership. The analysis work for the elaboration of the country reports will lead to the identification of the most prominent **FLOSS (Free/Libre Open Source Software) tools supporting personalised learning** (D2.3) and the identification of **motivational material for the promotion of e-Hoop to educators and learners through the design of a Training Unit targeting Educators and enhancing their ICT Competencies** (D2.4). Deliverables D2.3 and D2.4 may be revised several times until the end of the project in order to take into account any development with respect to the most prominent tools, as well as any new trends with respect to the top ten reasons for using e-Hoop from the viewpoints of educators and learners.

The objectives of the current document are to:

- ✓ Identify existing FLOSS tools supporting collaborative & personalised learning.
- ✓ Assess the tools with critical viewpoint to determine their usability/effectiveness and accessibility from the perspective of the disadvantaged/socially excluded and physically disabled learners.
- ✓ Determine the enabling technologies realising the tools and attempt to identify the pros and cons of each technology.

A set of criteria for a FLOSS tool to be oriented towards disadvantaged/socially excluded learners will be defined and a comparison matrix will be created to be used as a common tool for the assessment of all FLOSS tools.

2. Methodology

In order to proceed with the identification of the current CBT environment, and because of the large number of LMS platforms and eLearning tools currently in the market, we made a preliminary selection of web-based LMS and eLearning tools to be considered for further analysis. The preliminary selection was mainly based on the following criteria:

- Prominent platforms identified in the Learning Management System (LMS) Evaluation 2011-2012¹
- Platforms/tools that made it to the E-Learning 24/7 Blog² listing the top 10 LMS for 2013.
- Platforms/tools for which it was possible to obtain adequate information with regards to the comparison features listed in our comparison matrix (please refer to Section 2.1).
- Evaluation of e-Learning systems by edu tools and a paper by Morten Flate Paulsen, “Online Educations Systems: Discussion and Definition of Terms”, written for the Web Education Systems Project (Web-edu), supported by the European Leonardo da Vinci program³.

Based on these criteria, as well as on the platform’s ability to be customised and diversified in order to accommodate e-Hoop requirements, the e-Learning platforms listed in Table 2-1 were pre-selected to be considered for further analysis.

Table 2-1: Pre-selected e-Learning Platforms

Vendor	Platform	Web-Site
Moodle.org	Moodle	http://moodle.org/sites/
Uniqon	Sakai	http://sakaiproject.org/organization-list
University of Zurich	OpenOLAT	http://www.OpenOLAT.org/
Chamilo Association	Chamilo	http://www.chamilo.org
Instructure	Canvas by Instructure	http://www.instructure.com/
UCLouvain	Claroline	http://www.claroline.net
Joomla	Joomla	http://www.joomla.org/

Platforms/tools excluded due to insufficient information: Very little or no information was made available at the time of writing by the vendors of the platforms that were examined regarding the educational standards that are followed by each platform. Information was not kept up-to-date in most cases and as such is only indicative.

These pre-selected platforms are web based Learning Management Systems (LMS) that all have the functionality to support the organisation of online learning services and provide collaboration and personalisation services to students, educators. Typical services of this kind are the provision of user groups and access control, the delivery of learning content, student community building functionality, some form of student management functionality, etc.

In addition to being web-based LMS systems, we also examined these platforms for additional functionality, in order to identify their orientation towards disadvantaged/socially excluded

¹ <http://blogs.butler.edu/lms/files/2011/08/executive-summary.pdf>

² <http://elearninfo247.com/2013/02/28/top-10-lmss/>

³ The aim of the Web-edu project was to study web-based LMS to provide recommendations and reference material for European education and training organizations.

learners. The platforms that were identified as the most prominent in terms of collaboration/personalization features combined with high accessibility were evaluated in more detail in order to identify their strengths and weaknesses. The criteria used for evaluating the platforms in more detail, as well as the results, are presented in an evaluation matrix in Section 4.0.

The following e-learning functionalities have been considered during further analysis:

- **Collaborative Environment:** Platforms may include features aimed at facilitating collaborative learning. A collaborative environment is characterised by the provision of functionality to support activities such as:
 - synchronous and asynchronous communication
 - threaded discussion groups
 - real time chat
 - workflow
 - document versioning
- **Personalisation:** We look into platform functionality which serves personalization or could potentially serve personalization in the context of the envisaged e-Hoop extension. To this end, we consider important the provision of functionality simulating a virtual advisor and/or a virtual coach providing assistance for the optimal selection of courses by learners, but also detailed reporting to educators and learners with regards to progress accompanied by suggestions for improving weak performance in certain areas of a course.
- **Accessibility:** Platform should be particularly open to the disadvantaged groups. This requires that the platform is highly compliant to many accessibility features. To this end, we have not dived into the individual accessibility features as this would increase a lot the scope of work without justifiable benefit. Instead we checked the platform's compatibility to WAI WCAG 1.0 Levels⁴ A, AA and AAA⁵ and we assume that compliance to at least level AA is necessary for the platform to be considered open to the disadvantaged groups in the context of the e-Hoop project.
- **Content Management:** Platforms usually have a central repository (database) for educators and course creators to create, store, reuse, manage and deliver learning content. For the purposes of the current document, we refer to content management as a functionality provided by the system to support:
 - Content Creation: Platforms may have built-in functionality to allow the creation of courses using text files, slides, graphics, pictures, animations, etc. The content creation functionality is examined with respect to the support it provides for:
 - **Authoring:** functionality used by course designers, allowing them to use generic tools for creating their courses, such as Flash, DreamWeaver, FrontPage, Word, PowerPoint, etc., and utilize a template, etc. to create educational content.
 - **Assessment:** functionality used by educators to produce quizzes, multiple choice questions, etc.

⁴ <http://www.w3.org/WAI/intro/wcag.php>

⁵ <http://www.w3.org/TR/UNDERSTANDING-WCAG20/conformance.html#uc-levels-head>

- Technical:** We are looking into various technical aspects of the platform, such as the support for operating systems, application server and database, as well as the programming language the platform was written in and/or can be extended with. Interoperability is also very important for our purposes. Platform may be interoperable in terms of content or in terms of functionality and service usability by other platforms. The content may be semantically tagged in XML (e.g. using the Learning Material Mark-up Language XML standard for structuring the learning material), facilitating the discovery and usage of learning material. Then content is separated from the presentation and other platforms are able to use it without any special effort required. This enables the publication, from the same source material, to a number of formats and platforms and hence devices. In the case of functionality interoperability, we consider service provision via web services.

- Evaluation Matrix**

Using as reference the Content Management Systems presented by edu tools⁶, the criteria used by WBTIC for measuring quality in web-based training⁷, an overview of offered features was created in Table 2-2 while also an evaluation matrix was constructed (see Figure 1).

Table 2-2: Evaluation Features

Functionality	Description
Online Collaboration and communication	Platform should have functionality allowing asynchronous communication with document exchange facilities, email and support for threaded discussions, as well as synchronous communication, such as document versioning, workflow, online meetings and chat.
File exchange	Refers to the platforms functionality, allowing users to upload files from their local computers and share these files with instructors or other students in an online course.
Threaded discussions	Refers to the platforms functionality for capturing the exchange of messages over time, sometimes over a period of days, weeks, or even months. Threaded discussion forums are organized into categories so that the exchange of messages and responses are grouped together and are easy to find.
Multicasts	Refers to the platforms functionality for allowing two-way communication between multiple sites, as in videoconferencing, or sending a communication from one site to a group of selected receivers. Video services are an example since they enable instructors to either stream video from within the system, or else enable video conferencing, either between instructors and students or between learners.
Document Versioning	Refers to the platforms functionality for allowing the user to make changes to the attributes of a document or upload a newer version.
Workflow	Refers to the platforms functionality for supporting the definition of a series of tasks (or procedures), which need to be performed by one or more (or even all) members of a Workgroup, in order for multi-action sets of tasks to be completed. Such sets of tasks are called Workflow Processes. The workflow process allows the definition of complex tasks, as well as complex dependencies between them.

⁶ <http://www.edutools.info/course/>

⁷ http://www.wbtic.com/primer_quality.aspx

Functionality	Description
Real time chat	Refers to the platforms functionality for allowing a conversation between people that involves exchanging messages back and forth at virtually the same time, to take place over the Internet
Online Meeting	Refers to the platforms functionality for allowing the organisation and facilitation of meetings, both physical and virtual.
Internal Email	Refers to the platforms functionality for supporting electronic mail that can be read or sent from inside an online course. This functionality enables messages to be sent or read exclusively inside the course or alternatively the tools enable links to external email addresses of those in the course so that contacting course members is facilitated. Internal email may include an address book and some address books are searchable.
Group-work	Refers to the platforms functionality for organizing a class into groups and providing group work space that enables the instructor to assign specific tasks or projects.
Online support - Helpdesk - Documentation	Refers to the platforms functionality to help users of the system. These include telephone contact with a helpdesk, documentation, instruction, etc. Instructor Helpdesk tools may also enable faculty members to participate with another faculty in online discussion forums to share ideas or build knowledge.
Whiteboard	Whiteboard tools include an electronic version of a dry-erase board used by instructors and learners in a virtual classroom (also called a smartboard or electronic whiteboard) and other synchronous services such as application sharing, group browsing, and chatting.
Personalisation	Platform should offer functionality for supporting personalization features allowing users to take full advantage of the platforms capabilities and learn in a fast and efficient way.
Self-assessment	<p>Refers to the platform's functionality for allowing learners to take practice or review tests online (assessments do not count toward a grade). Self-assessments encourage learners to take responsibility for their own learning and to monitor their learning progress. Self-assessments can also facilitate learner motivation if learners receive feedback on the self-assessments and if there is a direct connection between the self-assessments and the measurement instruments the instructor uses to determine final course grades.</p> <p>A variety of testing strategies should be used and not just multiple choice questions. New self-assessment tests should follow new material covered and the assessment could be followed by feedback, remediation opportunities, or adaptive content delivery.</p>
Virtual Advisor	Refers to the platform's ability to propose learning modules to learners (also those using the platform for the first time) based on their profiles. The platform will present the learners with a questionnaire and analyse their replies to make suggestions for courses that should be undertaken by the learners. Learners may follow suggestions or ignore it and undertake courses of their choice.
Virtual Coach	Refers to functionality providing detailed reports on course progress to both learners and educators and suggestions for improving performance. Comparative reports capturing the performance of a complete class are also very useful for both educators and learners.

Functionality	Description
Portfolios	Refers to platform functionality facilitating areas where learners can showcase their work in a course, display their personal photo, and list demographic information.
Curriculum Management	Refers to the platforms functionality for providing learners with customized programs or activities based on prerequisites, prior work, or results of testing.
Content Creation and Course Delivery	Platform should have functionality for supporting various course-related activities, such as the creation of testing material and scoring methods, progress monitoring, etc. Platform should also offer functionality allowing instructors to quickly and effectively design and publish courses and assist students.
Automated Testing and Scoring	Refers to the platforms functionality for allowing instructors to create, administer, and score objective tests. The platform will probably support this through a questionnaire builder.
Course Management and Student Activity Tracking	<p>Refers to the platforms functionality for:</p> <ul style="list-style-type: none"> • Allowing instructors to control the progress of an online class through the course material. Specific resources in a course, such as readings, tests or discussions, can be made available to students for a limited time only or after some prerequisite is achieved. • Tracking the usage of course materials by students, and to perform additional analysis and reporting both of aggregate and individual usage. The platform generates useful reports about the activity of students in the course, the quizzes, the student community building and communication tools. The purpose of the reports is to give the tutor a didactically relevant feeling of what happens in a course.
Online Grading Tools	Refers to the platforms functionality for helping instructors mark, provide feedback on student work, manage a grade book.
Test Types	<p>Refers to functionality supporting a variety of test types:</p> <ul style="list-style-type: none"> • Multiple choice • Multiple answer • Matching • Ordering • Jumbled sentence • Calculated • Fill-in the blank • Short answer • Survey questions • Essay • Questions can contain other media elements (images, videos, audio) • Custom question types can be defined.
Accessibility Compliance	<p>Meeting the standards that allow people with disabilities to access information online. For example, the blind use a device called a screen reader to read the screen but Web pages need to be designed so that screen readers can navigate it easily.</p> <p>(Section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level A, AA, AAA)</p>

Functionality	Description
Instructional Design Tools	Instructional design tools help instructors creating learning sequences, for example, with lesson templates or wizards. It refers to functionality for instructors to organize learning objects, course tools, and content into learning sequences that are reusable and to create linear learning sequences organized hierarchically by course, lesson, and topic. Courses can be reused as templates for future lessons.
Instructional standards compliance	Refers to the platforms conformance to standards for sharing instructional materials with other online learning systems and other factors that may affect the decision whether to switch from this product to another. <ul style="list-style-type: none"> • AICC • IMS Content Packaging 1.1.3 • IMS Content Packaging 1.1.4 • IMS QTI 1.2.1 • IMS QTI 2.0 • IMS Enterprise 1.1 • IMS Metadata 1.2.2 • IMS Metadata 1.3 • Microsoft LRN • SCORM 1.2 • SCORM 1.3
Multilingualism	Refers to the platforms ability to offer courses in different translations and the ability to change the navigation language by the authors and/or learners.
Content Sharing/Reuse	Refers to functionality for instructors to share content with other instructors and students through a central learning objects repository and the availability of tools to enable version tracking and linking to specific versions as well as the creation and management of workflows for collaborative content creation and review. The repository normally supports IEEE LOM and metadata application profiles such as, Dublin Core, Cancore, and custom profiles.
Course Templates	Refers to the provision of templates (providing a step by step process) by the platform for helping instructors create the initial structure for an online course.
Customized Look and Feel	Refers to the platforms ability to change the graphics and hence the appearance of a course.
Course Creation Tools	Refers to the platforms functionality to support the creation of the content of online education courses by course designers. Content may include plain text, slides, graphics, pictures, animations, assessments, audio, video, etc. This kind of content is usually created with tools like DreamWeaver, FrontPage, Word, PowerPoint, Director, etc. There are however some tools made specifically for the creation of educational content.
Technical	Platform will have certain requirements in terms of software and hardware

Functionality	Description
Interoperability	<p>This is examined at two levels. In terms of content and in terms of service usability:</p> <ul style="list-style-type: none"> • Content: Refers to the platforms ability to semantically tag content in XML (e.g. using the Learning Material Mark-up Language XML standard for annotating the learning material), facilitating the discovery and usage of learning material. Content is separated from presentation and other platforms are able to use it without any special effort required. This makes it possible to publicise in a number of formats and platforms and hence devices, using the same source material. • Service: Refers to the platforms support for web services. Service provision via web services makes the platform interoperable in terms of functionality.
Database	Database Requirements are technical specifications for the database management software (e.g. Oracle or SQL) required by the course management system. We are looking for support of MySQL and PostgreSQL
Course Management Server Requirements	Unix Server means the course management system runs on a server using some variant of the Unix operating system. The Unix Server feature includes general information about hardware requirements such as disk space, memory (RAM), and CPU speed and model. Windows Server means the course management system runs on a server that uses some version of the Microsoft Windows operating system.
Application Server	Application server or application environment required to run (e.g. J2EE, APACHE, etc.)
Programming Language	The programming language the tool is written in and/or can be used to extend it (e.g. Java, PHP)
Web Server	The web server the tool is compatible with (e.g. APACHE)
Documented API (SDK)	API (application programming interface) provides a possibility to use functions of one application by another application. API allows integrating applications with encrypted source code and facilitates integration process for open source applications.
Integration via bridges	Bridges are special plugins which allow integrating applications of different types. Bridges are especially useful if you want to integrate applications with encrypted source code or applications with no API.
Open Source Licensing	Open Source means the software is delivered with the source code and the license agreement gives the licensee the right to modify and redistribute the software.

This evaluation matrix above was used for comparing the pre-selected platforms and identifying their strengths and weaknesses in relation to the features that the e-Hoop platform should have. The completed matrix for the pre-selected platforms of Table 2-1 is provided in Figure 2 of Section 4.

3. FLOSS tools supporting collaborative & personalised learning

Free and open-source software (F/OSS, FOSS) or free/libre/open-source software (FLOSS) describes the software that is both free (freeware) and open source. This kind of software enables users to use, to adapt and to expand it by improving its source code. FLOSS is increasingly gaining popularity among educators, educational and training institutions and simple users. Some categories of FOSS tools that serve educational and training purposes are the following:

- **LMS:** Learning Management System
- **CMS:** Content Management System
- **CLE:** Collaborative Learning Environment
- **VLE:** Virtual Learning Environment

Virtual Learning Environments act as fully online classes: An instructor can create a web site that serves as an online learning environment, complete with tools for communicating, structuring and sequencing learning content, creating assessments and evaluations, and/or collaborating with student participants.

- Blended learning environments: An instructor can create a web site that supplements face-to-face instruction with online tools for teaching, learning, communication, collaboration, assessment, and the use of ePortfolios
- Project collaboration sites: Faculty, staff and/or students can create web sites in which to work together on academic, professional, and co-curricular projects.
- ePortfolio sites: Faculty, staff, or students can create sites for building, assessing, evaluating, and presenting examples of their work in a reflective, fully online portfolio.
- Shared project resource sites: A project director can create a web site in which to make announcements and share documents, other files, or links to other references on the web.
- Fully online classes: An instructor can create a web site that serves as an online learning environment, complete with tools for communicating, structuring and sequencing learning content, creating assessments and evaluations, and/or collaborating with student participants.
- Blended learning environments: An instructor can create a web site that supplements face-to-face instruction with online tools for teaching, learning, communication, collaboration, assessment, and the use of ePortfolios
- Project collaboration sites: Faculty, staff and/or students can create web sites in which to work together on academic, professional, and co-curricular projects.
- ePortfolio sites: Faculty, staff, or students can create sites for building, assessing, evaluating, and presenting examples of their work in a reflective, fully online portfolio.
- Shared project resource sites: A project director can create a web site in which to make announcements and share documents, other files, or links to other references on the web.

3.1 Moodle⁸

Moodle an acronym for (Modular Object-Oriented Dynamic Learning) is an Open Source Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It has become very popular among educators around the

⁸ <http://docs.moodle.org/20/en/Features>

world as a tool for creating online dynamic web sites for students. In order to operate it has to be installed on a web server, or be hosted on web.

3.1.1 Collaborative environment

Table 1: Moodle Features: Collaborative Environment

 Online Collaboration and communication	
File exchange	<p>Moodle allows users to share (download files and upload files in any file format) with other users (both instructors and students). The following block is for sharing documents, files and links with others.</p> <p>Moodle block: File Sharing</p>
Threaded discussions	<p>Forum module allows users to exchange opinions on discussion boards asynchronously.</p> <p>Moodle modules: Forum</p>
Multicasts	<p>Moodle allows users to interact with multiple websites and concerning virtual online meetings.</p>
Document Versioning	<p>Users are enabled to make changes to the attributes of a document or upload a newer version of a document. The platform also let users know various information about the uploaded files, such as last modification date, file size etc.</p>
Workflow	<p>This block allows managing the process of producing courses or activities. A workflow makes it clear who is responsible for doing the next step, and what tasks they should be doing. The workflow can also assign and unassign roles, or automatically set certain settings, when the workflow moves from one step to the next.</p> <p>Moodle Blocks: Workflow</p>
Real time chat	<p>Chat module allows users to communicate with each other in real time.</p> <p>Activity Module: Chat</p>
Online Meeting	<p>Moodle activity plugins allow users to make virtual meetings enabling the use of real-time chat, audio and video conference. The most popular plugins are the following, versions of which are supported by Moodle versions 2.0 to 2.5.</p> <p>Activity Module: Video Conference Activity Activity Module: BigBlueButton Activity Module: Dimdim Web Meeting Activity</p> <p>The physical meetings can be arranged as an event marked on the Activity Module: Calendar.</p>
Internal Email	<p>Moodle enables messaging among users. There are three default types of output methods for messaging: popup notices, Jabber IM type messages, and messages sent as email.</p> <p>Moodle: Messaging</p>

Group-work	<p>The modules that are forming a collaborative environment for the users are the following:</p> <ol style="list-style-type: none"> 1. Choice module is a form of survey that allows users to respond to single question polls. Using this feature the instructor can obtain feedback about certain subjects easily. 2. Survey module can be used from the instructor in order to create polls and obtain student feedback. This module is supported by 3. Workshop module can allow peers to assess other peer assignments. 4. Wiki module enables users to collaboratively edit webpages and create a common version of a document/webpage along with other users.
Online support - Helpdesk - Documentation	Moodle cooperates with Certified Service providers across the globe, Moodle partners who provide technical support, instruction, Moodle configuration etc.
Whiteboard	Moodle does not offer whiteboard function in the main product release but this third party extension offers users the ability to use whiteboard on virtual meetings to chat, to view/edit resources collaboratively: Covcell Whiteboard Tool

3.1.2. Personalisation

Table 2: Moodle Features: Personalisation

 Personalisation	
Self-assessment	The instructor has the ability to add self-assessment tests, addressed to learners. Then learners can complete the self-assessment tests and be instantly notified for their scores (anonymously graded assignments). Instant feedback can be provided on each answered question and learners can retake the test. The ability for adaptive content delivery is not yet provided.
Virtual Advisor	Moodle doesn't offer users a virtual advisor but students can be aware for their learning path so far.
Virtual Coach	There is no such a functionality that provides detailed reports on course progress to both learners and educators and suggestions for improving performance. However the platform generates detailed statistics and reports about all the actions users take in the platform, which is very useful for both educators and learners.
Portfolios	Each user of the platform can personalise his/her personal page and personal portfolio. With e-Portfolios users are able to create their personal portfolios where they can showcase personal information and activities performed in the learning environment.

Curriculum Management	<p>Moodle is characterized by certain elements that can assist users personalize their learning experience and benefit the most from their participation in the VLE. Those elements refer to course characteristics and plugins such as:</p> <ul style="list-style-type: none"> • User Badges • Different Permission Levels and User Groups • The ability to control learning paths.
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3.1.3. Accessibility

Moodle platform complies with Section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level A guidelines, meeting the standards that allow people with disabilities to access information online (however not allowing full inclusion).

3.1.4. Content Management

Table 3: Moodle Features: Content Management

 Content Creation and Course Delivery	
Automated Testing and Scoring	<p>Moodle allows instructors to create, monitor and modify automated assessment tests. The results (along with graphs and other statistics) of the tests are easily accessible to learners and instructors.</p> <p>Activity Module: Quiz</p>
Course Management and Student Activity Tracking	<p>Moodle is :</p> <ul style="list-style-type: none"> • allowing instructors to control the progress of an online class through the course material. Instructors are able to upload the learning content in the platform and monitor students' interaction with the distributed materials (e.g. total time and frequency a user has interacted with a certain L.O.). • tracking the usage of course materials by students, and to perform additional analysis and reporting both of aggregate and individual usage.
Online Grading Tools	<p>Moodle platform allows educators to extract overviews and course reports regarding overall student performance on course activities, tests, overall time spent on the platform etc.</p> <p>Moodle Features: Course reports</p>

Test Types	<p>Moodle Platform Question types comprise the following elements:</p> <ol style="list-style-type: none"> 1. Standard question types <ul style="list-style-type: none"> • Calculated • Description • Essay • Matching • Embedded Answers (Cloze Test / Gap Fill) • Multiple Choice • Short Answer • Numerical • True/False 2. Third-party question types <ul style="list-style-type: none"> • Drag and Drop • Molecule design • Opaque • RQP • Regular Expression Short Answer
Accessibility Compliance	Compliance with section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level A.
Instructional Design Tools	<p>Moodle includes functionalities for <u>instructors to organize</u> learning objects, course tools, and content into learning sequences that are reusable and to create linear learning sequences organized hierarchically by course, lesson, and topic. Such as the following:</p> <ul style="list-style-type: none"> • Enrolment in courses • System roles • Course management (and more in particular): <ul style="list-style-type: none"> • Overview • Course Reports • Assignment module • Choice module • Forum module • Glossary module • Lesson module • Quiz module.
Instructional standards compliance	Moodle is compatible with established standards like IMS, SCORM, AICC, LAMS (including all individual versions).
Multilingualism	Moodle language packs include currently over 75 languages.
Content Sharing/Reuse	Moodle facilitates content tagging (with metadata) and redistribution.
Course Templates	Moodle offers documentation to administrators and course creators on how to create a course area. User interface is relatively easy to use.

Customized Look and Feel	Moodle in all its versions offers administrators the ability to change the appearance of a course area. Administrators can choose between a variety of themes and also among community generated extensions in order to reconfigure the look and feel of the platform. Users can have their personal files area (Google, Dropbox, Flickr, Youtube, Skydrive) as well as personal progress reminders and a customizable Home Page.
Course Creation Tools	Moodle is compatible with a variety of course creation tools. The most widely used being MS files, Flash content e.t.c

3.1.5. Technical

Table 4: Moodle Features: Technical

 Technical	
Interoperability	<ul style="list-style-type: none"> • The latest available version is Moodle 2.5.1 • Web services API are supported in a variety of protocols such as XML-PRC, REST and SOAP. <p>Moodle interoperability:</p> <ul style="list-style-type: none"> • Authentication • Enrollment, meaning direct interaction with an external database • Question Modules • Resources, meaning publishing e-content and materials according to established standards like IMS, SCORM, AICC, LAMS • Integration with Content Management Systems like Drupal and Joomla • Syndication, where external newsfeeds are displayed on the online learning environment. <p>Compatible Browsers: Minimum browser for accessing Moodle: Firefox 4, Internet Explorer 8, Safari 5, Google Chrome 11, Opera 9 plus whatever plugins and applications you will need for the content you plan to use.</p>
Database	<p>Regarding supported databases MySQL and PostgreSQL are the primary development databases, the most comprehensively tested and have extensive documentation and support.</p> <p>Others supported as well are:</p> <ul style="list-style-type: none"> • MySQL - minimum version 5.1.33 • PostgreSQL - minimum version 8.3 • MSSQL - minimum version 9.0 • Oracle - minimum version 10.2 • SQLite - minimum version 2.0

Course Management Server Requirements	Disk space: 160MB free (min) plus as much as you need to store your materials. 5GB is probably a realistic minimum. Backups: at least the same again (at a remote location preferably) as above to keep backups of your site Memory: 256MB (min), 1GB or more is strongly recommended.
Application Server	Not applicable.
Programming Language	PHP scripting language, as well as HTML & XML.
Web Server	Primarily Apache or IIS. Others not extensively tested (or supported) but also compatible are lighttpd, nginx, cherokee, zeus and LiteSpeed.
Documented API (SDK)	Available. Web services API
Integration via bridges	Applicable.
Open Source Licensing	Moodle is Open Source software, that is free to be obtain, modify, re-use and redistribute (under the terms of the GNU General Public License).

3.2 Sakai⁹¹⁰

The Sakai Collaboration and Learning Environment (CLE) is a Java-based, service-oriented web application that provides a variety of capabilities supporting teaching and learning, portfolios, research, and ad-hoc project collaboration.

3.2.1 Collaborative environment

Table 5: Sakai Features: Collaborative environment

 Online Collaboration and communication	
File exchange	Sakai enables users to upload and download files into the platform, in addition it offers a DropBox plugin which allows private file-sharing between instructors and students.
Threaded discussions	Forum module allows users to exchange opinions on discussion boards asynchronously.
Multicasts	Sakai allows users to exchange data between multiple websites. The following added plug Ins act as an example of such functionalities: <ul style="list-style-type: none"> • BlogWow Plug In: Supports blogging platform • Linktool: Support for linking to external tools • News:Display an RSS feed from an external site

⁹ Sakai 2.8 Release Notes:

<https://confluence.sakaiproject.org/display/DOC/Sakai+CLE+2.8+release+notes>

¹⁰¹⁰ Sakai Complete Feature List: <https://dl.seminolestate.edu/portal/site/!gateway/page/!gateway-300>

Document Versioning	Sakai allows the user to make changes to the attributes of a document or upload a newer version .
Workflow	Not available.
Real time chat	NeoChat module allows users to communicate with each other in real time.
Online Meeting	BigBlueButton Plug In is an extension that allows users to participate in virtual meetings and web conferences and exchange data visual and audio information in real time.
Internal Email	Users are able to use Internal Email, which maintains an archive of all email sent to the worksite's email list.
Group-work	<ul style="list-style-type: none"> • Wiki module enables users to collaboratively edit webpages and create a common version of a document/webpage along with other users. • Membership element: Choose sites in which you would like to participate also Sakai offers the functionality of auto grouping users • Site-based surveys and polls • Discussion forums and communication between site groups and users using internal mail • Schedule: Keeping track of important dates and deadlines on worksite calendar.
Online support - Helpdesk – Documentation	<p>Sakai unlike Moodle (which is supported by commercial affiliates) has multiple hosts.</p> <p>The four main Sakai community lists are:</p> <ul style="list-style-type: none"> • Announcements (announcements@collab.sakaiproject.org) - items of community-wide interest in Sakai • Building Sakai (sakai-dev@collab.sakaiproject.org) - designing, developing, testing, and documenting Sakai • Using Sakai (sakai-user@collab.sakaiproject.org) - teaching and learning, collaboration, and other uses of Sakai • Deploying Sakai (production@collab.sakaiproject.org) - implementing, installing, configuring, and supporting Sakai (find release documentation; learn about performance tuning; browse suggested hardware and software configurations; share examples of training, tutorial and support materials). For sysadmins, DBAs, and technical support staff. <p>Latest Version Product Release Notes Services and Support Partners</p>
Whiteboard	Included in other plug Ins such as BigBlueButton.

3.2.2 Personalisation

Table 6: Sakai Features: Personalisation

 Personalisation	
Self-assessment	Sakai includes, Test & Quizzes (Samingo -3 rd party contribution) as well as a Turnitin Integration which enables users to submit their assignments online and be automatically graded.
Virtual Advisor	Not available.
Virtual Coach	Not available.
Portfolios	<ul style="list-style-type: none"> • Portfolios: Supports portfolio-based activities with a suite of tools • Post'em: Provides functionality for uploading .csv formatted files to display feedback (e.g., comments, grades) to site participants. • Preferences: Sets personal preferences, such as time zone, tab order • Profile: Provides a Facebook-style interface for editing user profiles; includes Twitter integration • Quartz Scheduler: Schedules and runs cron jobs • Resources: Enables users to add documents and URLs to your worksite
Curriculum Management	Automated recommendation systems regarding learning materials not enabled.

3.2.3 Accessibility

Sakai platform complies¹¹ with Section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level A guidelines, meeting the standards that allow people with disabilities to access information online (but not in a big extend).

¹¹ Sakai WCAG Compliance:

<https://confluence.sakaiproject.org/display/2ACC/Sakai's+WCAG+1.0+Compliance>

3.2.4 Content Management

Table 7: Sakai Features: Content Management

 Content Creation and Course Delivery	
Automated Testing and Scoring	Samigo test and quizzes has a number of upgrades including assessment-type-templates, ability to set scores for sets of students with unsubmitted assessments, a new matrix survey question type, scientific and complex number notation
Course Management and Student Activity Tracking	All user actions are documented, in addition the Search tool, provides search capabilities of Sakai content.
Online Grading Tools	Automated scoring and testing tools.
Test Types	Various test types and question banks.
Accessibility Compliance	WAI WCAG 1.0 Level A compliance.
Instructional Design Tools	<ul style="list-style-type: none"> • Lesson Builder: Enables educators to create a course area. • Site Info: View worksite profile and participants list • Site Stats: View site usage statistics • Syllabus: Create a worksite syllabus • Home: View recent announcements, discussions, and chat activity • Announcements: Post current, time-critical information • Assignments: Post assignments and receive submissions online • Gradebook: Compute and store grades • Section Info: Manage sections or groups within a site
Instructional standards compliance	Sakai is SCORM 1.2 and IMS compliant.
Multilingualism	Sakai is supported in 21 fully tested languages.
Content Sharing/Reuse	Shortened URL Service A simple service that allows tools and services to shorten links to anything, either via the Java-based service or the Entity Provider.
Course Templates	Styles allow control of the look of matrix cells, wizards, wizard pages, and templates.
Customized Look and Feel	Fully supported, the following are some examples of the extensions for this purpose: Sakai Kaltura Extension (3rd Party Contribution) Textbook (3rd Party Contribution) Sakai RSF (Support for site language)
Course Creation Tools	Available.

3.2.5 Technical

Table 8: Sakai Features: Technical

 Technical	
Interoperability	<p>Latest available Sakai version is 2.9.x. and it integrates with a variety of external authentication services including CAS, Kerberos, LDAP, Shibboleth and WebAuth.</p> <ul style="list-style-type: none"> • Basicliti: Launch and exchange information with externally-hosted tools • Entity Broker: Provides a set of RESTful APIs that support interoperability between Sakai tools.
Database	<p>By default all Sakai distributions are configured to use an in-memory version of HSQLDB on start up. HSQLDB is adequate for testing or local development but does not offer the same reliability and scalability as a more robust relational database. A single database, usually MySQL or Oracle, provides a transactional store of information while file storage is typically delegated to NAS or SAN solutions. In most production settings, the Sakai CLE relies on a back-end student information system (SIS) to provide it with student and course information, which the Sakai CLE consults via provider APIs.</p>
Course Management Server Requirements	<p>Not applicable.</p>
Application Server	<p>The Apache Tomcat servlet container provides an ideal environment for running Sakai as a web application. Tomcat implements both the Java Servlet and JavaServer Pages (JSP) specifications and can be run in standalone mode or in conjunction with a web application server such as the Apache HTTP server or JBoss. Sakai 2.8 works with the Tomcat 5.5 series.</p>
Programming Language	<p>The Sakai CLE is typically deployed using Apache Tomcat as its servlet (JAVA programming language) container and scalability is achieved by running multiple instances of Tomcat in a clustered environment, each deploying a copy of the Sakai CLE</p>
Web Server	<p>If you plan to run Tomcat as a standalone web server as opposed to running it in conjunction with the Apache HTTP server then you will want to make a further minor change that may spare some confusion later. The ROOT webapp is the one served up when a request is made to Tomcat's root URL.</p>
Documented API (SDK)	<p>Sakai 2.8 requires JDK 1.6.</p>
Integration via bridges	<p>Applicable. Integrating Sakai.</p>
Open Source Licensing	<p>Sakai is Open Source software, that is free to be obtain, modify, re-use and redistribute (under the terms of the GNU General Public License).</p>

3.3. OpenOLAT

OpenOLAT derives from OLAT which means "Online Learning and Training", and is an open-source learning platform. In 1999 OpenOLAT was launched by the Computer Science Department at the University of Zurich (UZH). In September 2000 the OpenOLAT team at that time won the MEDIDA Prix. This as well as OpenOLAT's success opened new possibilities: In 2001 the Computer Science Services at the UZH took charge of OpenOLAT, offering professional operation and support as well as further software development. OpenOLAT has been used as a strategic learning platform at the UZH since 2004. At present OpenOLAT is employed at all faculties of the UZH as well as the ETH Zurich; there are more than 50'000 registered users.

3.3.1 Collaborative environment

Table 9: OpenOLAT Features: Collaborative Environment

 Online Collaboration and communication	
File exchange	Available. As well as the following: <ul style="list-style-type: none"> • Uploading solutions to DropBox • Downloading solutions to Return box.
Threaded discussions	The forum is used most of the time for exchanging information among course participants or for contacting the course author.
Multicasts	OpenOLAT supports interoperability among different sites. An example of this is Vitero and DropBox course elements.
Document Versioning	Versioning is only stored for the Wiki pages of the platform, not for individual files.
Workflow	Not available.
Real time chat	In the OpenOLAT Chat you can exchange messages with other OpenOLAT users in real time.
Online Meeting	The "vitero" course element allows you to embed the vitero system for web conferencing, e-collaboration, live e-learning and language learning into the course. Vitero (virtual team room) enables meetings creation for up to 12 participants plus moderator. The virtual meeting room facilitates communication via text, audio and video as well as document and desktop sharing. The vitero system can be used for virtual team meetings, but also supports e.g. lectures ("chalk-and-talk"). All meetings work with the three temporary roles of moderator, assistant moderator and participant, thus reflecting the olat course roles administrator, coach and participant.
Internal Email	By means of the course element "E-Mail" course participants are provided with the possibility to send an e-mail to pre-defined recipients. There are two possibilities to send messages. You can either select groups and learning areas you want to send a message to in the tab "Recipients" or you directly indicate your e-mail addresses.

Group-work	Project groups are meant for collaborative work outside a course context, e.g. when writing a term paper in groups, when preparing a presentation, when working jointly on some academic publication, or when planning to communicate with other group members via forum or chat. All OpenOLAT users can create project groups and invite another OpenOLAT user to join. Only group members will have access to that group; it is not public.
Online support - Helpdesk – Documentation	Community Support and Service Providers.
Whiteboard	Vitero course element offers participants the ability to use a whiteboard.

3.3.2 Personalisation

Table 10: OpenOLAT Features: Personalisation

 Personalisation	
Self-assessment	Contrary to tests, results of self-tests will be stored anonymously. Self-tests are suitable for practicing and can be taken as often as you like.
Virtual Advisor	Not available.
Virtual Coach	Not available.
Portfolios	<p>An ePortfolio is used to document learning results as well as learning processes and is therefore meant to assist in reflecting on someone's process of development. The menu entry ePortfolio serves to create accumulative folders of portfolios before making those accessible to certain people (OpenOLAT users as well as guests).</p> <p>The following artefacts can be assembled:</p> <ul style="list-style-type: none"> • Posts in forums • Files in folders • Wiki pages • Evidences of achievement • Posts in blogs
Curriculum Management	Not available as such, but it has supporting tools facilitating curriculum management.

3.3.3 Accessibility

OpenOLATplatform complies with Section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level AA guidelines, meeting the standards that allow people with disabilities to access information online (for example people having difficulties with their vision).

3.3.4 Content Management

Table 11: OpenOLAT Features: Content Management

 Content Creation and Course Delivery	
Automated Testing and Scoring	Available, as well as these course elements: Questionnaires & Assessment.
Course Management and Student Activity Tracking	OpenOlat allows full-text search for search terms in the course or group content, in a forum or even in PDF and Word files. This function is enabled for users, portfolio folders, artefacts, and documents in any user folder. The only exceptions are private folders since they will not be indexed.
Online Grading Tools	Questionnaires are used for online evaluations during a course. By means of a questionnaire the educator can learn more about what your participants expect from your course before its beginning.
Test Types	Tests are created as independent learning resources before embedding them in a course. The educator decides whether a test should be a self-test for practice purposes or a real test for examination purposes.
Accessibility Compliance	OpenOLAT platform complies with Section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level AA guidelines, meeting the standards that allows people with disabilities to access information online.
Instructional Design Tools	Available.
Instructional standards compliance	<ul style="list-style-type: none"> • OpenOLAT supports the IMS CP version 1.1.2. • Another standardized e-learning format supported by OpenOLAT is the SCORM format (version 1.2).
Multilingualism	Various language packs available.
Content Sharing/Reuse	Each learning resource will be explained in the detailed view by means of metadata. These metadata give further information on e.g. who has access to learning content. The owner of a learning resource can modify the name of his learning resource, its description or access as well as add other owners.
Course Templates	Course Element: Structure The course element "Structure" serves to arrange courses. By default it offers an automatic overview of all sub-elements along with short title, title, and description. This course element is to arrange course content and/or to clearly separate modules.
Customized Look and Feel	There are themes available allowing site admins to change platforms layout.
Course Creation Tools	OpenOLAT courses can represent lectures, seminars, group puzzles or problem-based learning.

3.3.5 Technical

Table 12: OpenOLAT Features: Technical

 Technical	
Interoperability	OpenOLAT is a web application. In order to work with OpenOLAT there is a need an internet connection as well as a modern web browser. OpenOLAT is optimized for Mozilla Firefox (2.0 and up), a browser that can be downloaded for free.
Database	MySQL (version 5.0.x or later.) On UNIX systems OpenOLAT recommends that MySQL runs under a dedicated user (e.g., "mysql") for security reasons.
Course Management Server Requirements	OpenOLAT is a Java based web application employs both database and filesystem for persistent storage needs. OpenOLAT recommends the MySQL database which requires that you use the InnoDB storage engine. The application itself is packaged as a Web Archive (WAR) and deployment merely requires that it be placed in an appropriate web container such as Apache Tomcat. If OpenOLAT is deployed in a load balanced topology then it is also necessary to install a JMS middleware component such as ActiveMQ. Optionally it is possible to integrate an XMPP instant messaging for which OpenOLAT uses the Openfire server.
Application Server	Tomcat.
Programming Language	OpenOLAT is a web application and is mostly written in Java.
Web Server	Tomcat web container (version 6.x or later) to host the web application. On UNIX systems OpenOLAT recommends that Tomcat runs under a dedicated user (e.g., "tomcat") for security reasons. In situations where more than one instance is required (e.g., multiple cluster nodes on the same host) it is worth setting up each OpenOLAT instance in its own JVM and sharing a common base installation
Documented API (SDK)	JDK SDK 1.6 must be installed on your Tomcat host and when compiling from source. Note that it is not sufficient to have a JRE installed as Tomcat requires the compiler at runtime! It is, however, possible for JDK 1.6 to co-exist on systems that already have other JDKs installed.
Integration via bridges	Applicable.
Open Source Licensing	OpenOLAT is an open-source software (OSI Certified) which means that its code is at user's disposal for free. It can be downloaded, used, adapted and further developed without the need of license fees.

3.4 Chamilo

Chamilo is a new project that opts for open source in a radical way. It aims at bringing out an improved e-learning and collaboration platform in the open source world. It comes in two editions: Chamilo LMS, improved version of a software created in 2001, and Chamilo LCMS Connect, still in development, a new taste of e-learning and much more, bringing fresh and creative tools to e-learning experience.

3.4.1 Collaborative environment

Table 13: Chamilo Features: Collaborative Environment

 Online Collaboration and communication	
File exchange	This feature is enabled.
Threaded discussions	Social network tool which allows users to create common interest groups where users will be able to discuss between them as on a forum.
Multicasts	Provided that the appropriate extension is enabled, this option is available.
Document Versioning	Split users' upload directory allows users to improve speed a little for very high load platforms by splitting the users directories (but this requires a manual operation on disk as well).
Workflow	Available as a third party extension.
Real time chat	The Chat tool is available and the instructor can store previous chat sessions, using them as a learning resource.
Online Meeting	For virtual meetings and web conferences the BigBlueButton videoconference Tool must be enabled. Once enabled, it will show as an additional course tool in all courses' homepage, and teachers will be able to launch a conference at any time.
Internal Email	Chamilo incorporates this feature and also allows users to send emails even when the platform is unavailable.
Group-work	The Social Media tool allows educators to include various social media elements such as forums and wikis, which facilitate group activities.
Online support - Helpdesk – Documentation	Support Forum Chamilo Official Providers
Whiteboard	It is available as part of the BigBlueButton plugin.

3.4.2 Personalisation

Table 14: Chamilo Features: Personalisation

 Personalisation	
Self-assessment	Available.
Virtual Advisor	Not available.
Virtual Coach	Virtual coaching is not offered but the Personal tutoring tool, allows educators to create virtual classes with one or more students. With the sessions, simple definition of one new session per student. The instructor can register the courses each student has access to and set his own coach to the session. Both student and coach will now be able to work in an isolated virtual space.
Portfolios	Available using the tool User profiles.
Curriculum Management	The platform allows educators to store course sessions as well as,back ups of the courses themselves, allowing them to monitor the learning progress and make adjustments when necessary.

3.4.3 Accessibility

Chamilo complies with Section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level AAA guidelines, meeting the standards that allow people with disabilities to access information online.

3.4.4 Content Management

Table 15: Chamilo Features: Content Management

 Content Creation and Course Delivery	
Automated Testing and Scoring	Multiple such tools are available such as questionnaires, quizzes and grade books.
Course Management and Student Activity Tracking	Statistics tool can generate small statistical charts for four categories of data: <ul style="list-style-type: none"> – courses, – users, – system, – social.
Online Grading Tools	Also available.
Test Types	Exercises, quizzes and glossaries.
Accessibility Compliance	Chamilo is WCAG level AAA compliant.

Instructional Design Tools	There is a variety of such tools available that enable instructors to create courses, upload learning objects, manage user groups and adding learning activities.
Instructional standards compliance	Chamilo is compatible with SCORM and, something less obvious, SCORM 1.2, which is a particular version of SCORM. Chamilo does not fully support SCORM 2004, but it is AICC compatible.
Multilingualism	Languages This tool allows you to define which languages are visible by the users during their subscription to the platform or during the course creation process.
Content Sharing/Reuse	This action is facilitated because Chamilo is Instructional Standards compliant.
Course Templates	Available.
Customized Look and Feel	Document templates allow you to speed up the creation of contents in Chamilo. Creating new templates in this part of the platform will affect the whole platform. The style sheets allow you to define the global visual style of your platform. Search This category allows you to configure the fulltext indexing feature of Chamilo Enable users time zones will let users define their own time zones, and thus get all the times on the platform displayed in their own time zones.
Course Creation Tools	There are various course creation tools that allow educators/site administrators to edit the layout and offered educational tools.

3.4.5 Technical

Table 16: Chamilo Features: Technical

 Technical	
Interoperability	The platform's latest version 1.9.6. works on most operating systems: <ul style="list-style-type: none"> • GNU/Linux, BSD, UNIX • Windows (XP, Vista, 7) • Mac OS X
Database	MySQL 5.1 database
Course Management Server Requirements	Chamilo can be installed on Windows, Linux, Mac OS X and UNIX servers indifferently. However, we recommend the use of Linux server for optimal flexibility, remote control and scalability.
Application Server	Chamilo is mainly a LMS running Apache 1.3, 2.0
Programming Language	PHP 5.1.

Web Server	To run Chamilo LMS on a local server, the following instalments must be performed WAMP, LAMP or MAMP: <ul style="list-style-type: none"> • To install WAMP (AMP on Windows), we recommend the XAMPP .exe installer • To install LAMP (AMP on Linux), use the Package manager of your favourite distribution (Synaptic, RPMFinder etc.). For instance, on a Ubuntu server, use Shell or Synaptic following the Ubuntuguide on Apache and the following sections • To install MAMP (AMP on Mac OS X), refer to the MAMP dedicated website
Documented API (SDK)	Available as a third party extension.
Integration via bridges	Feature available.
Open Source Licensing	Chamilo is free to download and use (GNU/GPLv3 licence) which essentially grants the user the freedom to use, study, modify and distribute the software.

3.5 Canvas

Canvas by Instructure is a learning platform addressed to Learning Management System that Professional and educational uses extend further than those of the traditional LMSs. For example its adaptable architecture allows its easy integration with other websites and applications, also its interoperability with mobile devices is particularly enhanced.

3.5.1 Collaborative environment

Table 17: Canvas Features: Collaborative Environment

 Online Collaboration and communication	
File exchange	Feature available.
Threaded discussions	Feature available.
Multicasts	Interoperability with multiple sites, apps and devices.
Document Versioning	Each user, course, and collaboration group has their own file management screen so you can see and organize all the files you have uploaded into Canvas.
Workflow	Not supported.
Real time chat	Feature available.
Online Meeting	Web conferencing tool is enabled.

Internal Email	Feature available.
Group-work	A variety of such tools is available, such as Wikis, integration with Social Media platforms etc.
Online support - Helpdesk – Documentation	http://twitter.com/canvassupport for updates on Canvas. http://help.instructure.com/entries/21670287-canvas-status-updates for updates on Canvas. Very good level of technical support.
Whiteboard	Enabled as part of the web conferencing tool.

3.5.2 Personalisation

Table 18: Canvas Features: Personalisation

 canvas <small>BY DESIGN</small> Personalisation	
Self-assessment	Assignments, quizzes, discussion groups, grading, and course content tools.
Virtual Advisor	Not available.
Virtual Coach	Not available.
Portfolios	Feature enabled. In addition users can choose to make public e-Portfolios (that is to make them public on the web).
Curriculum Management	The student's outcome achievements are automatically recorded and can be tracked for reporting purposes, to identify at-risk students, or for use in accreditation.

3.5.3 Accessibility

Canvas conforms with the W3C's Web Accessibility Initiative Web Content Accessibility Guidelines (WAI WCAG) 2.0 AA and Section 508 guidelines.

3.5.4 Content Management

Table 19: Canvas Features: Content Management

 Content Creation and Course Delivery	
Automated Testing and Scoring	Feature available. (In addition Speed Grader reduces the time to correct an assignment).
Course Management and Student Activity Tracking	Student activity reports assist educators track learning progress.
Online Grading Tools	Online grade books are available.
Test Types	Quizzes contain various question types such as multiple choice, true false etc.
Accessibility Compliance	Canvas conforms with the W3C's Web Accessibility Initiative Web Content Accessibility Guidelines (WAI WCAG) 2.0 AA and Section 508 guidelines.
Instructional Design Tools	A variety of tools available.
Instructional standards compliance	Canvas supports some SCORM (Shareable Content Object Reference Model) content natively, but not all.
Multilingualism	Canvas' default language is English, but also supports French, Spanish, Russian, Arabic, Chinese, Portuguese, and Japanese. (Thus a limited amount of languages). Language preferences can be set by the user, by the instructor on a specific course, or by the site Admin for the entire account.
Content Sharing/Reuse	This option is facilitated.
Course Templates	Feature available.
Customized Look and Feel	Themes allow instructors to change the layout of the learning environment.
Course Creation Tools	Feature available.

3.5.5 Technical

Table 20: Canvas Features: Technical

 Technical	
Interoperability	<p>Email:</p> <ul style="list-style-type: none"> • RSS/Atom Feeds • LDAP • SAML • iCal • E-Packs/Publisher Content • IMS QTI • RSS • Podcasts • Basic LTI • SCORM • Common Cartridge <p>As of May 17, 2013, the following browsers and Flash versions are also supported:</p> <ul style="list-style-type: none"> • Internet Explorer 9 and 10 • Chrome 24, 25, and 26 • Safari 5 and 6 • Firefox 19, 20, and 21 • Flash 9, 10, and 11
Database	The platform is web hosted.

Course Management Server Requirements	<p>Computer Specifications Canvas and its hosting infrastructure are designed for maximum compatibility and minimal requirements.</p> <p>Screen Size</p> <ul style="list-style-type: none"> • A minimum of 1024x600. That is the average size of a netbook. You probably won't want to view Canvas on a smaller screen than that. <p>Operating Systems</p> <ul style="list-style-type: none"> • Windows XP SP3 and newer • Mac OSX 10.6 and newer • Linux - chromeOS <p>Mobile OS Native App Support</p> <ul style="list-style-type: none"> • iOS 5 and newer • Android 2.3 and newer <p>Computer Speed and Processor</p> <ul style="list-style-type: none"> • Use a computer 5 years old or newer when possible • 1GB of RAM • 2GHz processor <p>Internet Speed</p> <ul style="list-style-type: none"> • Along with compatibility and web standards, Canvas has been carefully crafted to accommodate low bandwidth environments. • Minimum of 512kbps <p>Screen Readers</p> <ul style="list-style-type: none"> • The latest versions of JAWS and VoiceOver
Application Server	<p>Not applicable, as Canvas is a cloud service.</p>
Programming Language	<p>Ruby on Rails</p>
Web Server	<p>Not applicable.</p>
Documented API (SDK)	<p>Canvas allows for programmatic access to some pieces of information via the Canvas API. API calls require authorization, and are made on behalf of an authorized user.</p>
Integration via bridges	<p>Canvas can be integrated with various student information systems (SIS) in many ways to build accounts, courses, enrollments, and more. It has also (free) applications suitable for mobiles and tablets.</p> <p>Also good interoperability with other website and apps (such as Google apps).</p>
Open Source Licensing	<p>Canvas is free to download and use (GNU/GPLv3) and has also commercial uses (Commercial AGPL).</p>

3.6 Claroline

Claroline is an OSS based e-learning platform (PHP/MySQL) and offers a collaborative learning environment that enables instructors and educational institutions to create and administer courses through the web. The most powerful feature of Claroline, apart from its free-based license, is probably the fact that it is translated in 28 languages and is worldwide used by numerous institutions.

3.6.1 Collaborative environment

Table 21: Claroline Features: Collaborative Environment

 Online Collaboration and communication	
File exchange	The content management functionality of Claroline includes support for publishing documents in any format (Word, PDF, HTML, Video, etc.).
Threaded discussions	There is a forum tool enabled.
Multicasts	Feature available.
Document Versioning	Feature available.
Workflow	Existing tools can assist educators create learning workflows.
Real time chat	Feature available.
Online Meeting	Integration for Web Conferencing Tools such as DimDim.
Internal Email	Feature available.
Group-work	The platform offers functionality to support a collaborative learning environment. These functionality includes threaded discussion forums(admin, public, or private), document repositories, calendar, real-time chat (it is possible to have a chat room for every group), assignments areas, and announcements (it is possible to send messages to selected course members and groups).
Online support - Helpdesk - Documentation	Claroline, like Moodle is supported by commercial affiliates. Documentation on product features can be found on Claroline's Wiki .
Whiteboard	Available as element of the BigBlueButton Plug In.

3.6.2 Personalisation

Table 22: Claroline Features: Personalisation

 Personalisation	
Self-assessment	Corresponding tools enabled.
Virtual Advisor	Not available.
Virtual Coach	Not available.
Portfolios	Available under user profiles.
Curriculum Management	Not available.

3.6.3 Accessibility

Claroline complies with Section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level A guidelines (however doesn't offer full inclusion to people with special needs.)

3.6.4 Content Management

Claroline offers a web-based course management system that allows instructors to create and administer course websites through commercial web browsers.

Table 23: Claroline Features: Content Management

 Content Creation and Course Delivery	
Automated Testing and Scoring	Quizzing, grading and reporting are all included.
Course Management and Student Activity Tracking	Advanced tracking system.
Online Grading Tools	Quizzing, grading and reporting are all included.
Test Types	Question types such as quiz, multiple choice, pairs, filling the gap are included.
Accessibility Compliance	Claroline complies with Section 508 of the US Rehabilitation Act and WAI WCAG 1.0 Level A
Instructional Design Tools	Course creation, assessment, grading, monitoring tools and learning material management tools.
Instructional standards compliance	The SCORM 1.3 XML standard is implemented. Web services were initially started to be implemented, precisely for SCORM interoperability, but have been halted. Currently, a more simple implementation is available.
Multilingualism	There are various language packs supported (28 languages so far).
Content Sharing/Reuse	Facilitated action.
Course Templates	Feature available.
Customized Look and Feel	Feature available.
Course Creation Tools	Claroline allows Course deliverers to create and administer course website through a browser.

3.6.5 Technical

Table 24: Claroline Features: Technical

 Technical	
Interoperability	The latest version of claroline is 1.11.8. Web services will be implemented in the future again, as soon as the need becomes apparent.
Database	The MySQL databases server plus a login/password allowing to administrate and create several databases.
Course Management Server Requirements	One of the following Operating systems : <ul style="list-style-type: none"> • Linux / BSD / Unix (*) • Windows (9x, Me, NT4, 2000, 2003, XP) • MacOS X.
Application Server	Not applicable.
Programming Language	PHP 4.x configured with the following modules : mysql, zlib, preg. Most of the PHP4 compiled distributions are provided with these modules.
Web Server	A web server, such as Apache is the most preferable option.
Documented API (SDK)	Kernel API (Interconnection between LMS and SCO objects).
Integration via bridges	Feature available. (e.g. integration with DimDim).
Open Source Licensing	Claroline is free to download and use (GNU/GPLv3 licence).

3.7. Joomla

Joomla is a free and open-source content management framework (CMS) for publishing web content. It is built on a model–view–controller web application framework that can be used independently of the CMS.

Joomla is written in PHP, uses object-oriented programming (OOP) techniques and software design patterns, stores data in a MySQL, MS SQL, or PostgreSQL database, and includes features such as page caching, RSS feeds, printable versions of pages, news flashes, blogs, polls, search, and support for language internationalization.

As of July 2013, Joomla has been downloaded over 35 million times. Over 6,000 free and commercial extensions are available from the official Joomla! Extension Directory, and more are available from other sources.

It has become very popular among educators around the world as a tool for creating online dynamic web sites for students. In order to operate it has to be installed on a web server, or be hosted on web.

3.7.1. Collaborative environment

Table 25: Joomla! Features: Online collaboration and communication

 Online Collaboration and communication	
File exchange	This feature is provided through the CMS. Joomla allows users to share (download and upload files in any file format) with other users (both instructors and students) in a secure environment.
Threaded discussions	Social network tool which allows users to create common interest groups where users will be able to discuss between them as on a forum.
Multicasts	Provided that the appropriate extension is enabled, this option is available.
Document Versioning	Users are enabled to make changes to the content of an article which is published in the frontend side of Joomla depending on their privileges. Alternative they could upload a newer version of an article.
Workflow	<p>There are many components that allows managing the process of producing courses or activities</p> <ul style="list-style-type: none"> • Guru which is an open source LMS extension allowing the creation of online educational modules and quizzes, • LMS King which is an open source LMS extension offering an easy to use and manageable eLearning portal, • Joomlalearn LMS which is an open source LMS extension used to provide access to training content, • Joomla allows for the centralization of user profiles ensuring consistency of user details between Joomla and Moodle and their associated extensions.
Real time chat	Available as a third party extension (integrate a chat module).
Online Meeting	For online meetings there are external components which can be added in the CMS.
Internal Email	Available as is in the basic features of Joomla.
Group-work	Joomla allows users to include various social media elements such as forums and wikis, which facilitate group activities.
Online support - Helpdesk - Documentation	www.joomla.org http://forum.joomla.org/
Whiteboard	Available as a third party extension.

3.7.2. Personalisation

Table 26: Joomla! Features: Personalisation

 Personalisation	
Self-assessment	Joomla has a wide area of provided components such as test, quizzes or polls.
Virtual Advisor	This feature is not available. Instead of that Joomla offers an online help desk through its CMS.
Virtual Coach	Not available.
Portfolios	Joomla provides a user secure area in order to allow every user to create a personal profile, to publish articles and other content and also to share it with others.
Curriculum Management	The platform allows end users to store course sessions as well as, back-ups of the courses themselves, allowing them to monitor the learning progress and make adjustments when necessary.

3.7.3. Accessibility

Joomla has a dedicated section which provides modules and plugins in order to provide and ensure accessibility for all.

Joomla provides a solution capable of delivering accessible websites that comply with WCAG 1.0 Priority 2 and Section 508 requirements by release 1.5 of Joomla!

A guidelines, meeting the standards that allow people with disabilities to access information online (however not allowing full inclusion).

3.7.4. Content Management

Joomla is a very popular Content Management System and many characteristics concerning the content management are covered from its core components and modules. Regarding the content creation and the course delivery features Joomla community provides a variety of LMS components which allow Joomla CMS extends its educational characteristics.

The following LMS components are the most popular in Joomla community and the most appropriate for e-Hoop project according to our research.

- Guru¹² which is an open source LMS extension allowing the creation of online educational modules and quizzes,
- LMS King¹³ which is an open source LMS extension offering an easy to use and manageable eLearning portal,
- Joomlalearn LMS¹⁴ which is an open source LMS extension used to provide access to training content.

¹² <http://extensions.joomla.org/extensions/living/education-a-culture/lms/18393>

¹³ <http://extensions.joomla.org/extensions/living/education-a-culture/lms/25164>

Table 27: Joomla! Features: Content Creation and Course delivery

 Content Creation and Course Delivery	
Automated Testing and Scoring	Test, quizzes, polls and other testing and scoring components and modules are available through the huge research and development community of Joomla.
Course Management and Student Activity Tracking	Many management courses and student tracking through Guru component.
Online Grading Tools	Allows educators to extract overviews and course reports regarding overall student performance on course activities, tests etc.
Test Types	Various test types and question banks.
Accessibility Compliance	Joomla now has firm goals to aim for Accessibility in several areas. Joomla provides to users with the tools to create WCAG 1.0 Priority 2 and Section 508 compliant websites.
Instructional Design Tools	<p>The abovementioned LMS components includes functionalities for educators to organize learning objects, course modules, and content into learning sequences that are reusable and to create linear or non-linear learning sequences organized hierarchically by course, modules and lesson. Such as the following:</p> <ul style="list-style-type: none"> • Enrolment in courses • System roles • Course management (and more in particular): <ul style="list-style-type: none"> • Table of content • Jump buttons • Forum module • Media Library • Lesson module • Exams module • Students' tracking module • Quiz module.
Instructional standards compliance	Allows compatibility with established standards like SCORM, LAMS.
Multilingualism	Joomla is supported in various languages.
Content Sharing/Reuse	Content tagging (with metadata).

¹⁴ <http://extensions.joomla.org/extensions/living/education-a-culture/lms/3715>

Course Templates	Various course templates are supported. Many different views of the same learning material are supported in order to allow educator to have choices according to learners' needs.
Customized Look and Feel	Different layouts are supported.
Course Creation Tools	Compatible.

3.7.5. Technical

Table 28: Joomla! Features: Technical

 Technical	
Interoperability	<ul style="list-style-type: none"> • Web services API are supported in a variety of protocols such as XML-PRC, REST and SOAP. <p>Joomla interoperability:</p> <ul style="list-style-type: none"> • Authentication • Enrollment, meaning direct interaction with an external database • Resources, meaning publishing e-content and materials according to established standards • Extended by using LMS component and modules like Guru • Integration with LMS like Moodle • Syndication, where external newsfeeds are displayed on the online environment. <p>Compatible Browsers for accessing Joomla: Mozilla Firefox, Internet Explorer, Safari, Google Chrome, Opera.</p>
Database	<ul style="list-style-type: none"> • MySQL (InnoDB support required) • MSSQL • PostgreSQL
Application Server	<ul style="list-style-type: none"> • Apache (with mod_mysql, mod_xml, and mod_zlib) • Hiawatha (with UrlToolkit support) • Nginx • Microsoft IIS
Programming Language	PHP, MySQL
Web Server	<ul style="list-style-type: none"> • Apache (with mod_mysql, mod_xml, and mod_zlib) • Hiawatha (with UrlToolkit support) • Nginx
Documented API (SDK)	The Joomla Content Management System (CMS) is built on top of a core of code which presents a standard Application programming interface or API to the applications built on it.
Integration via bridges	JFusion is a free GPL plugin for the award winning Content Management System (CMS) Joomla. JFusion provides universal user integration, by extending the Joomla 1.5 user authentication framework without any core hacks. JFusion does not support every software out-of-the-box, but is designed for people to easily write a plugin to create a bridge, without re-inventing the wheel.

Open Source Licensing

Joomla is Open Source software that is free to be obtained, modified, re-used and redistributed (under the terms of the GNU General Public License).

4. Comparative Analysis

	Moodle	Sakai	OpenOLAT	Chamilo	Canvas	Claroline	Joomla
Online Collaboration and communication							
File exchange	✓	✓	✓	✓	✓	✓	✓
Threaded discussions	✓	✓	✓	✓	✓	✓	✓
Multicasts	✓	✓	✓	✓	✓	✓	✓
Document Versioning	✓	✓	✓	✓	✓	✓	✓
Workflow	✗	✗	✗	✓	✗	✗	✓
Real time chat	✓	✓	✓	✓	✓	✓	✓
Online Meeting	✓	✓	✓	✓	✓	✓	✓
Internal Email	✓	✓	✓	✓	✓	✓	✓
Group-work	✓	✓	✓	✓	✓	✓	✓
Online support - Helpdesk – Documentation	✓	✓	✓	✓	✓	✓	✓
Whiteboard	✓	✓	✓	✓	✓	✓	✓
Personalisation							
Self-assessment	✓	✓	✓	✓	✓	✓	✓
Virtual Advisor	✗	✗	✗	✓	✗	✗	✗
Virtual Coach	✗	✗	✓	✓	✗	✗	✗
Portfolios	✓	✓	✓	✓	✓	✓	✓
Curriculum Management	✓	✓	✓	✓	✓	✓	✓
Content Creation and Course Delivery							

	Moodle	Sakai	OpenOLAT	Chamilo	Canvas	Claroline	Joomla
Online Collaboration and communication							
Automated Testing and Scoring	✓	✓	✓	✓	✓	✓	✓
Course Management and Student Activity Tracking	✓	✓	✓	✓	✓	✓	✓
Online Grading Tools	✓	✓	✓	✓	✓	✓	✓
Test Types	✓	✓	✓	✓	✓	✓	✓
Accessibility Compliance	✓	✓	✓	✓	✓	✓	✓
Instructional Design Tools	✓	✓	✓	✓	✓	✓	✓
Instructional standards compliance	✓	✓	✓	✓	✓	✓	✓
Multilingualism	✓	✓	✓	✓	✓	✓	✓
Content Sharing/Reuse	✓	✓	✓	✓	✓	✓	✓
Course Templates	✓	✓	✓	✓	✓	✓	✓
Customized Look and Feel	✓	✓	✓	✓	✓	✓	✓
Course Creation Tools	✓	✓	✓	✓	✓	✓	✓
Technical							
Interoperability	✓	✓	✓	✓	✓	✓	✓
Database	✓	✓	✓	✓	✗	✓	✓
Course Management Server Requirements	✓	✗	✓	✓	✓	✓	✓
Application Server	✓	✓	✓	✓	✗	✗	✓
Programming Language	✓	✓	✓	✓	✓	✓	✓
Web Server	✓	✓	✓	✓	✓	✓	✓
Documented API (SDK)	✓	✓	✓	✓	✗	✓	✓
Integration via bridges	✓	✓	✓	✓	✓	✓	✓
Open Source Licensing	✓	✓	✓	✓	✓	✓	✓

Figure 1 - Comparison Matrix Results

5. Conclusions

The present study analysed the technical and operational characteristics of six (6) learning platforms. The analysis took into consideration the objectives of the e-Hoop project.

The research revealed that the LMSs under scrutiny, had in many cases similar characteristics or offered similar services to their users. Other factors considered important towards LMS selection are:

- LMSs ease of use
- Personalisation
- Level of Technical Support/Documentation

Taking into consideration all the elements that were analysed in all preceding tables it is concluded that Moodle remains the top learning management system (in terms of usability and popularity). However there are other LMSs that are gaining momentum such as Sakai which offers a more flexible and adaptable architecture. Its major disadvantage is the lack of proper and detailed documentation may discourage educators lacking solid technical knowledge, towards its use.

As for the rest LMS that have been examined they display similar characteristics to the aforementioned two. Another LMS that is increasingly gaining popularity is Canvas LMS by Instructure. Canvas architecture allows its easy integration with many online tools and websites and also with good records of user experience. The only disadvantage of Canvas LMS is its limited language availability.

Joomla however includes most of the desired features of the training platform. Joomla is popular open source software for business and educational solutions. Its interface is relatively easy to use and it includes various tools and advanced features (e.g. multimedia library) that allow designers and creators a high degree of customisation. Joomla community is ever growing proving that it is a flexible tool that can be adjusted to meet various learning needs.

6. Online database of FLOSS tools

This is an [online database of FLOSS tools](#) that will be constantly updated.