

# essense

Education Supporting  
Smart Environments for  
Seniors

## Learning platform specifications



Erasmus+

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# 1. Introduction

Based on the [Joint curriculum summaries](#) and the [Educational Philosophy](#), the Course materials that will be developed as outputs from the ESSENSE projects are required to cover an interdisciplinary topic and the Units are quite diverse in both content and the required format of materials. The Educational Philosophy defines the nature of the learning environment and gives directions towards what didactic material formats should the learning platform support and briefly defines the content that needs to be added to the learning platform. Furthermore, both the Joint curriculum summary and the Educational philosophy define the types of learning outcomes that are expected to be achieved by the students and recommends the means to evaluate if the students have achieved these outcomes.

The requirements for the platform for managing the ESSENSE training programme:

- Compatibility with SCORM and Tin Can for developing structured pedagogical objects
- Allowing multi-institutions mode
- Allowing time-controlled exams
- Allowing tracking of user (students) progress
- Integration of social networks
- Integration of interactive training content
- Needs to support Alfatraining system – alfaview® for video tutorials, webinars and other video activities

Considering the requirements for the platform, the platform of choice for hosting the curriculum didactic content, materials, videos and presentations, should allow the students to interact with the teachers and to be able to communicate using the alfaview® system for teleconferencing. A platform that can support such level of customization is a Learning Management System (LMS) called Moodle<sup>1</sup>. According to the Moodle documentation, Moodle is a free, online LMS that enables educators to create their own private website filled with dynamic courses. Moodle is customizable and contains a lot of modules that are ready to use of the shelf and allows developers to customize or implement new modules.

This document was prepared with the understanding that establishing the proper vision and objectives of the new software product and the proper documentation of a consistent, robust, well understood, and complete set of functional and non-functional requirements is essential for System development and deployment success.

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<sup>1</sup> <https://moodle.org/>



## 2. Platform actors

Considering both the Educational Philosophy and the Joint curriculum summary, we define three types of actors in the system: Administrator, Teacher and Student. Each of these actors has a role defined in the Moodle platform.

The Administrator creates the courses and enables or disables features. Usually this is a technical person that is not directly involved in the teaching and in the defining of the teaching materials, tests and grading of the students. The Administrator is responsible for the health state of the LMS and for keeping the LMS running. The Administrator also makes sure to keep all content secure and to perform regular backups so that the teaching content and the student progress is maintained.

The Teacher as actor is responsible for creating the course and adding the didactic materials in the course. As the course is divided in five units and each unit has several types of materials including text, videos and presentations. The teacher is also responsible for defining the outcomes and the grades by creating and adding activities that are expected to be performed by the student and later grading the outputs that the student attached for the corresponding activity.

The Student is the consumer of didactic content and materials. Using the teacher guidelines, the student is expected to study the materials and perform the activities within the required time limits defined by the Teacher. The Student activities are in the form of assignments, presentations, tests, and individual and team projects.

Since the Administrator role is customization and implementation, in the following text we will focus on the Platform features and use-cases that are intended for the Teacher and Student role.



### 3. Platform features and use-cases

#### General requirements

##### **SCORM-ADL compliant**

The platform should comply with the SCORM 1.2 specification. The SCORM (Sharable Content Object Reference Model) is a set of specifications and standards for web-based e-learning. Users can deliver SCORM content via the platform by uploading any SCORM or AICC package to a course.

##### **Interoperability**

In supporting the seamless integration and use of content from different sources and multiple vendors, the platform should be able to exchange data using open industry standards for Web deployments, and should support:

1. Authentication using:

LDAP, the most widely used standard protocol for authentication.

Direct database lookup (e.g. in an external Oracle database), or on the Shibboleth protocol, or alternatively using IMAP, NNTP, CAS or FirstClass.

2. Enrolment using:

LDAP server (e.g. Active Directory)

IMS Enterprise standard (via a downloadable plugin).

3. Content using the import of Reusable Learning Objects, packaged according to the SCORM/AICC/IMS Content Packaging standards.

The platform should be SCORM 1.2 compliant.

4. Quiz questions via import and export using a variety of formats.

5. RSS newsfeeds integrated into the platform's site or course.

Forum discussions, glossary entries and database content can be accessed as RSS newsfeeds, and therefore integrated into other RSS-capable websites or systems.



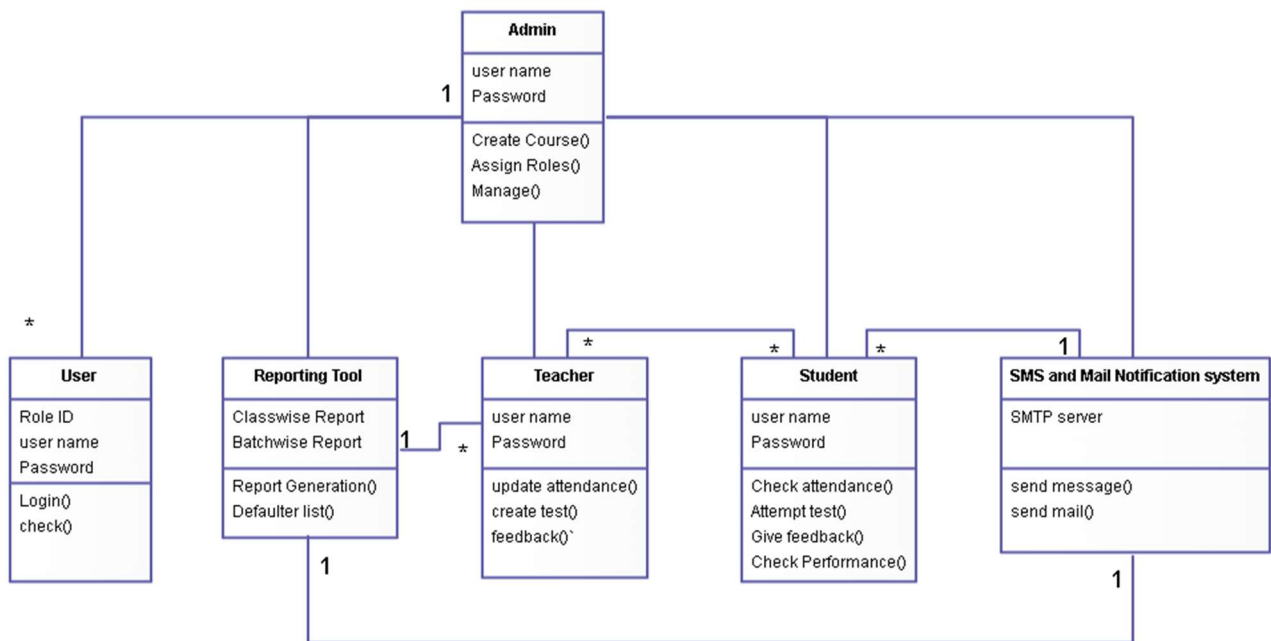


Figure 1 General classes in Moodle

The class diagram in Figure 1 shows the general features that should be available including Reporting tool for generating student reports and messaging options using Mails, internal messages and notifications. Additionally, the system should be extended using the alfaview® software plugins.



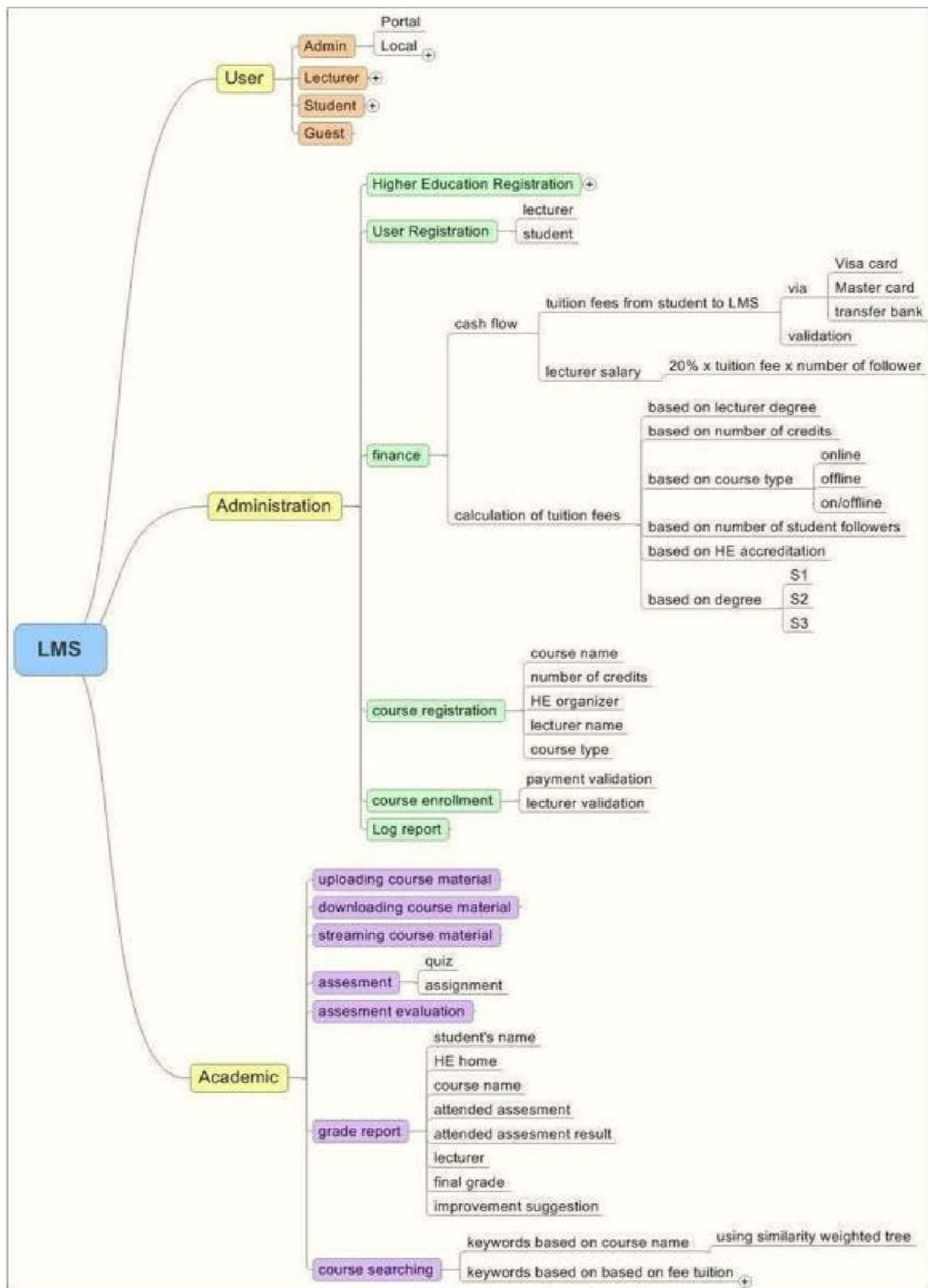


Figure 2 LMS Design





## Required learning platform features

Moodle allows both students and teachers to use different types of features and plugins. Also, some features offer different user experience for teachers and for students. For example, the student interacts with the Quiz feature, while the teacher is the one who sets it up. Both students and teachers interact with the platform during the course and use the platform. The Moodle platform has an extensive documentation available online [1].

The features supported by Moodle for the teacher are adding activities, editing text, adding teaching resources and materials, creating question banks for quizzes, enrolling students in the courses, grading, defining outcomes, tracking progress, creating groups of students etc.

As per the requirements for the ESSENSE course, we add an additional plugin, namely the Alfaview videoconferencing plugin, that allows live video communication between the students and the teachers which is important for having interaction.

The features supported by Moodle for students are enrolment in the course, opening and downloading materials, taking tests, uploading materials for assignments etc. Additionally, the students will be able to use the Alfaview plugin for videoconferencing with the teachers or peers within the same course.

We define the following use-cases or activities that should be implemented for the ESSENSE learning platform:

### Teacher adds resource

The teacher adding resource use-case is depicted in Figure 3. When a teacher adds a resource, by default the LMS (moodle) allows for creation of several resource types:

- Book – defines a book-like organization of learning material, specifically using chapters and subchapters. It can be defined as a multipage resource that besides text and images, it can utilize the multimedia nature of the web. hence, it allows for creation of media rich resources, as well as internal and external hyperlinks. It does not support interactivity and its purpose is creation of structured learning material.
- File – allows a file to be uploaded to the platform, that can be visible to all participants of the course.
- Folder – provides organizational structure that can group multiple resources.
- IMS Content Package – provides material that is formatted according to the IMS standard for content packaging , as defined in [2]
- Label – enables creation of short HTML based resources. Used for short text or multimedia segments that are embedded directly on the course page.
- Page – creates a HTML based web-page. It can encompass all of the features of a standard webpage like inline frames, audio and video elements, etc.
- URL – enables creating of hyperlinks to an URL (external or internal).



Figure 3 Teacher adds resource use-case



## Teacher defines outcomes

Teacher defines outcomes and for each activity selects which outcomes apply to it. The use case can be seen in Figure 4 Outcomes must be enabled by Administrator. The student can achieve outcomes (Competences, Goals) by finishing activities set up by the Teacher.

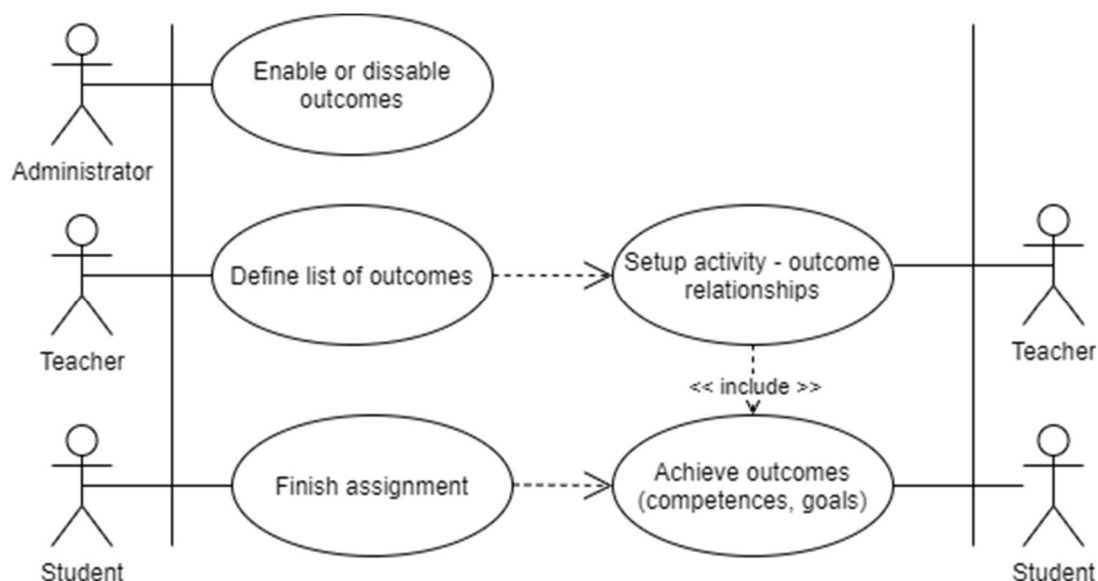


Figure 4 Outcomes use-case

## Teacher creates questions

Moodle supports quite a few question types for creating quizzes. After creating the questions the questions are saved in a question bank where the questions can be allocated to different groups, subjects, units etc. The following question types are supported by Moodle:

- Calculated
- Calculated multi-choice
- Calculated simple
- Drag and drop into text
- Drag and drop markers
- Drag and drop onto image
- Description
- Essay
- Matching
- Embedded Answers (Cloze Test / Gap Fill)
- Multiple choice
- Short Answer

- Numerical
- Random short-answer matching
- Select missing words
- True/False

Moodle also supports custom types of questions such as questions that support Mathematical formulas, question types that are able to run source code and be evaluated and questions that allow dragging and dropping markers in an image. The LMS is intended for usage for BIM and AAL course curriculum and should have these additional question types:

- Coderunner
- Drag and drop marker
- Freehand drawing
- External task
- Short Math

Other question type add-ons can be provided and installed if necessary, by the Administrator.

### Teacher creates assignment

Using this feature, the teacher can define an assignment that must be completed, usually in a timely manner (Figure 5).

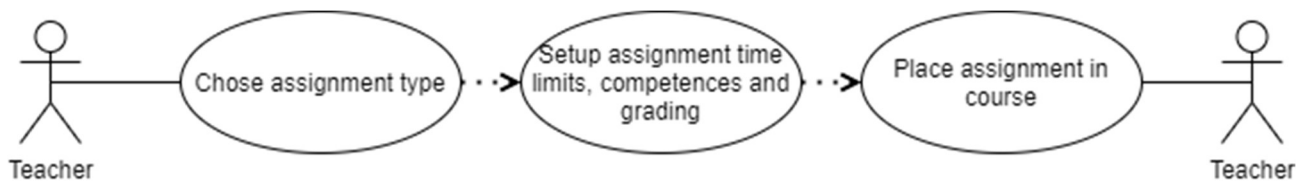


Figure 5 Teacher creates assignment use-case

Several types of assignments are available on Moodle:

- Online text – where the student writes text directly in a text box
- File submission – where student uploads a single file (or a zipped folder containing files)
- Both online text and file – Upload a file and write text online
- Offline work – student assignment where students work offline and send results to teacher through other communication tool

The Teacher can give feedback to the assignment by grading it, adding feedback comments etc.



## Teacher creates quiz

The following activity diagram shows the process of creating a quiz (Figure 6). Moodle supports customizing quizzes by defining scales and grades for questions, defining question groups by difficulty and by defining the grade of the quiz itself.

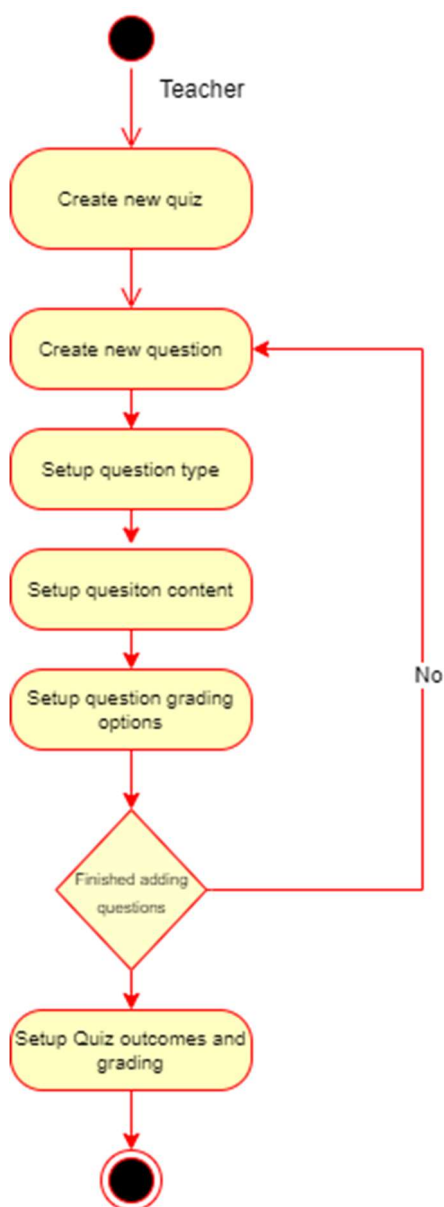


Figure 6 Quiz creation activity diagram

## Teacher creates feedback pool

To obtain feedback by the students and to better manage the learning, the teacher should be able to create pools. This functionality is also available in the Moodle LMS.

## Teacher adds alfaview resource

The teacher should be able to add alfaview® activity in the course in order to organize live seminars and meetings between students and other teachers in the course. The alfaview® activity



should be available in the list of resources and activities that the teacher can add in the course. More details about the alfaview resource is given in Section 5.

## Teacher creates groups

Teachers should be able to create groups of students for the students to be separated when doing team projects or other reasons. Using Moodle LMS, it is possible to create groups on course level or on activity level and to give or deny access to resources and activities to different groups.

## Teacher tracks progress

Moodle LMS allows the teachers to track the student progress. There is also a notification capability to notify teachers after a certain period if there are students that are not finishing the tasks on time and are falling behind on the material.

The general use-case of the teacher role can be seen in Figure 7 :

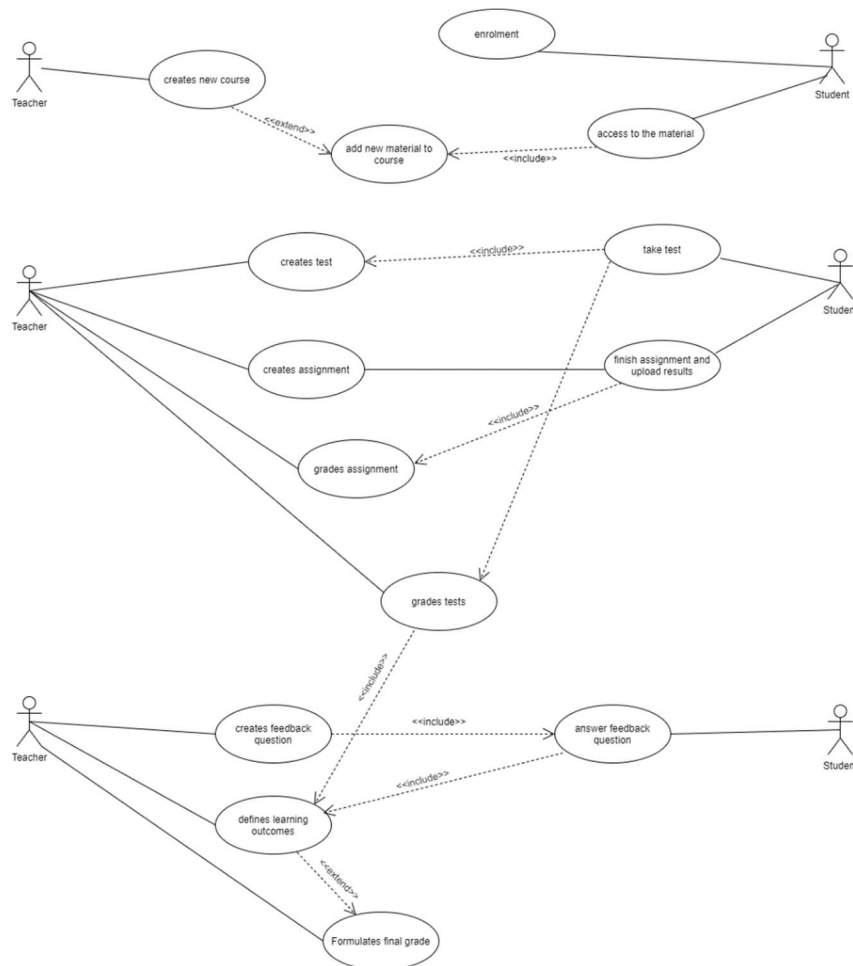


Figure 7 Teacher role general use-cases

## Student enrolls

The teacher should be able to enroll students in the course. This functionality is available and is integrated in the Moodle platform. The Administrator first creates the user accounts and then the Teacher is able to enroll the students automatically or manually. There are options of integrating Moodle with other systems for the purpose of student management and enrollment.



### **Student downloads materials**

The student should be able to access the resources and materials that the teacher allowed him or her to. Students after authentication should be able to view their courses and all of the available course materials.

### **Student takes quiz**

At certain time the student should be able to take the quiz that was created by the teacher. After authentication the student can access and take a time limited quiz with questions either randomly selected by the system or pre-selected by the teacher. The student should be able to see the questions and interact with them using the interface. Based on the feedback type, the student receives the results after the quiz in the form of points or points and solutions of the questions.

### **Student participates in feedback**

Students should be able to use the system to participate in feedback pools and give feedback when requested by Teachers.

### **Student participates in Alfaview® conference**

After the Teacher has set up the resource or activity and created an Alfaview® room, students should be able to access the room and communicate with Teachers and peers. Students should install the Alfaview® software on their device and use the resource just to start or initialize the video call.

### **Student uploads files for assignment**

The software should allow students to upload files in certain activities such as assignments. The Teacher should be able to define the maximum size of the files and limit the time window when the upload is available for the student. The student can then upload the files for the assignment at the specified place in the specified time window.

## 4. Platform architecture

The LMS for the learning platform, Moodle, follows a classic architecture (Figure 8).

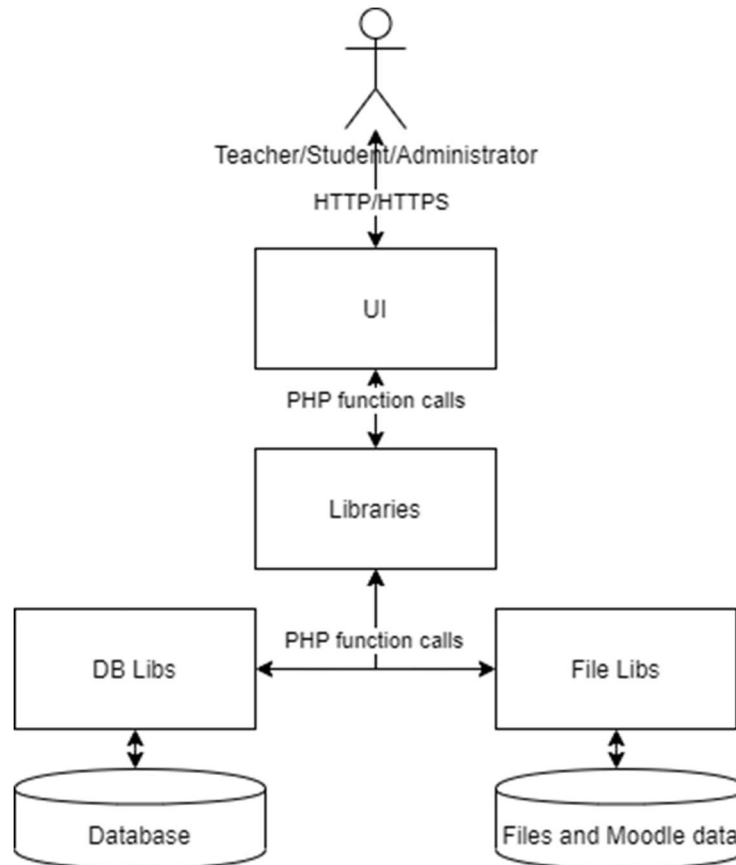


Figure 8 Moodle General Architecture

The core Moodle is consisted of a set of libraries that are responsible for the application logic, the communication with the file system and the database. This three-layered architecture is typical for applications that need to scale, decoupling the data layer from the application logic (backend) and the front-end layer that is responsible for the visual presentation of the application towards the user.

One of the most desired Moodle features is the scaling. Moodle can be scaled and even clustered to support large number of concurrent users. Some Moodle plugins also allow separate hosting which further increases the scaling capabilities. Moodle clusters are known to support hundreds of thousands of accounts with tens of thousands of courses and over 1000 concurrent users.

The Moodle platform is consisted of multiple plugins that can be installed and used for managing the content of the courses or creating different types of activities. Each plugin also adheres to the same architecture using the three-layered design. As it can be seen in Figure 9. The Core libraries communicate with the Core UI, while the plugin UI (Quiz, Forum etc.) communicate with their corresponding libraries and also keep separate entries in the Core data (i.e. the data layer).



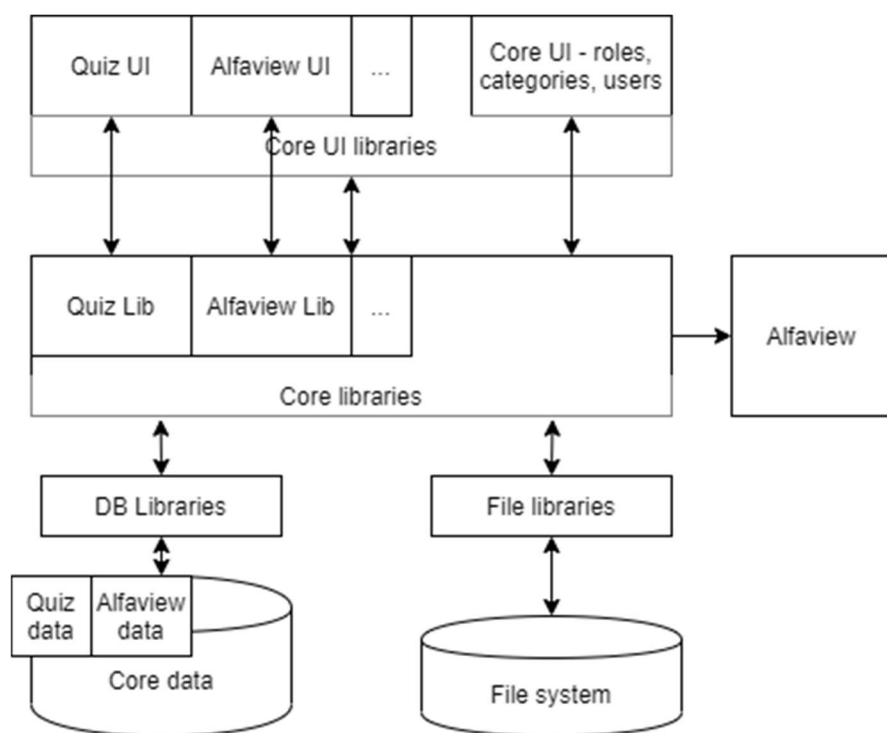


Figure 9 Moodle architecture with plugins

Additionally, as it can be seen in Figure 9, the LMS must support connectivity with the Alfaview. The connectivity is described in more detail in the following section.



## 5. Connectivity with Alfaview®

### Introduction

alfaview is an app-based video conferencing system (<https://alfaview.com>). The Moodle plugin integrates the alfaview video conferencing capabilities with Moodle.

More specifically, the plugin allows Moodle courses to be configured as an online classroom. Via API communication the plugin generates a personalized join link for each enrolled user. When alfaview is installed on the participant device, he or she can launch the online classroom directly from the course detail page in Moodle.

### Prerequisites

#### alfaview and Moodle

Two things are required - a working Moodle installation and an alfaview account. The alfaview administration page offers API credentials which have to be configured in Moodle after the plugin installation.

#### Setup an online classroom

After the plugin installation and configuration, create a course in Moodle. In the course configuration select 'Single activity format' as a course format, then select 'alfaview classroom' as type of activity. In the course activity configuration select an alfaview conference room.

#### Download and install the alfaview app

In order to join an alfaview classroom, all participants need to install the alfaview client app. The client application is available for download at <https://alfaview.com/downloads>, where students and teachers can download the latest version of alfaview for their operating system.

### Technical overview

#### Requirements

- The plugin should provide connection to the third party alfaview API
- The API connection should be configurable and verified through the plugin settings
- Teachers should be able to connect a course to an alfaview room by searching and selecting from a list of rooms fetched by the plugin
- Teachers and students should be able to join an alfaview room if they are a part of the Moodle course too
- Teachers and students who join the room should be identified by their own names on alfaview too
- Teachers should have higher permissions on alfaview in order to administrate the video conference

#### Data storage

The plugin stores data in two separate tables in the Moodle database (Figure 10). First is the relation between an alfaview room and a course. The second is the credentials for a single room, one for the teachers and one for the students.

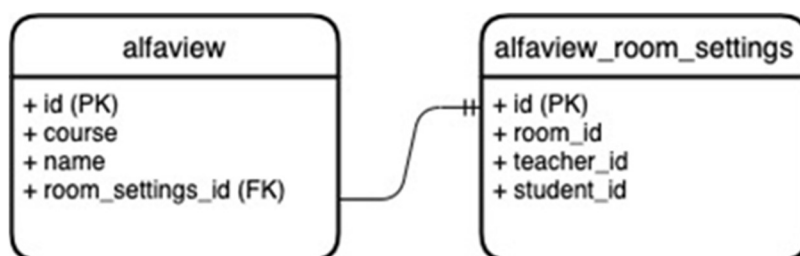


Figure 10 Database model of alfaview

## Functionality

The alfaview Moodle plugin provides communication between the Moodle system and the alfaview API (Figure 11). Users must create API credentials through the alfaview web app and input these credentials in the alfaview Moodle plugin after installing it. With API access the plugin can retrieve rooms that have been created and provide access to them.

When a course is created in the format of a single activity, the activity type can be selected to be an alfaview classroom. After this selection the plugin will retrieve the rooms in the alfaview account and allow for a single room selection. Once the selection has been saved the alfaview Moodle plugin will create access credentials, one for teachers and one for students. These credentials are stored in the Moodle database to be used later.

Users who visit the course after authenticating on the Moodle platform will be able to follow a link to launch the alfaview app and join the video conference. The plugin authenticates each user with the previously stored credentials to get a link from the alfaview API that launches the alfaview App.

The following flow diagram visualizes the functionality to adding an alfaview room to a Moodle course and launching alfaview through the Moodle course page for participants.

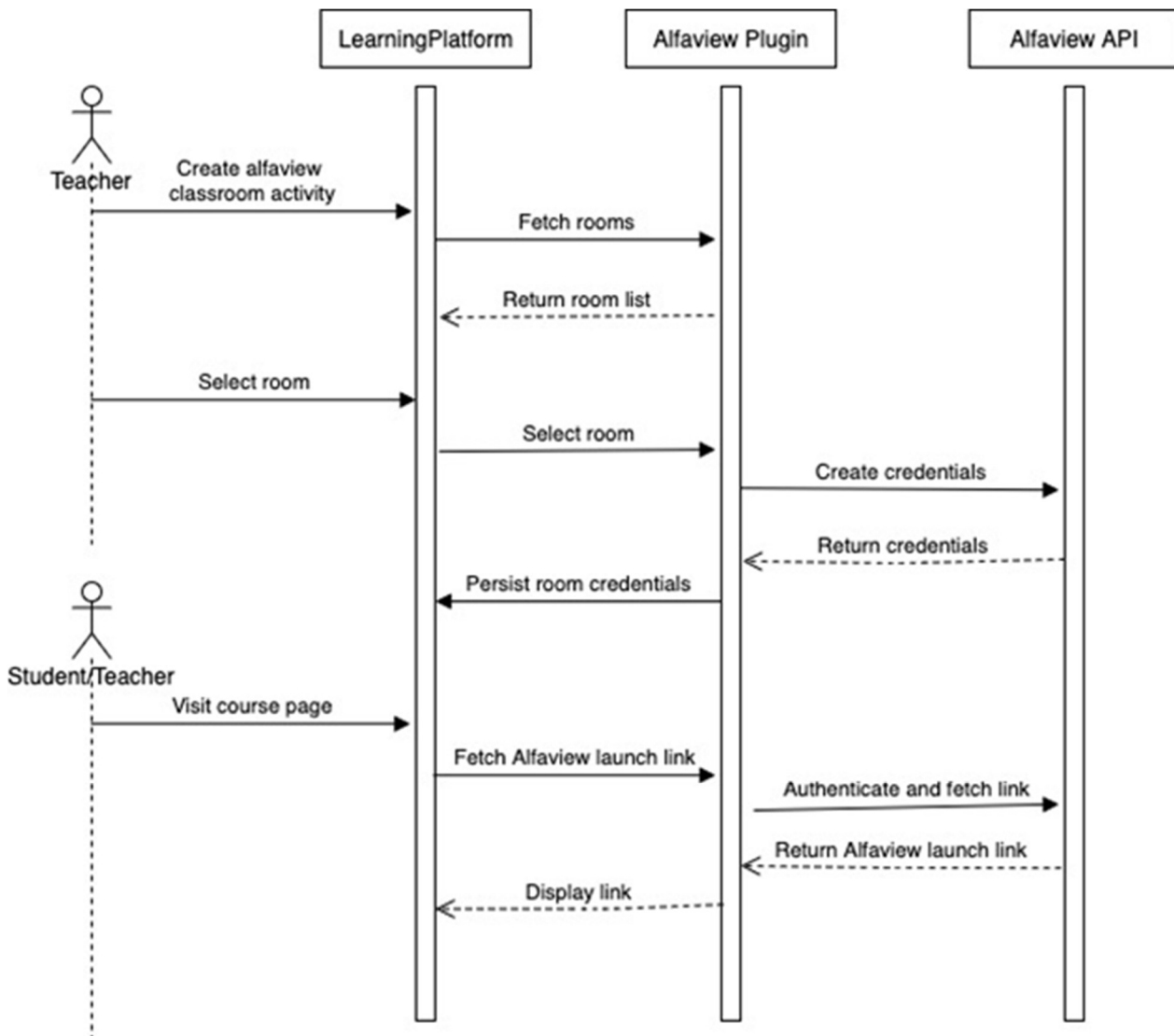


Figure 11 alfaview plugin sequence diagram



## 6. Non-functional requirements

The technical solution must meet the following requirements:

- The web LMS should be accessible from both 32 bit and 64 bit operating systems;
- The web LMS should be accessible from all operating systems: Windows, Linux and mac OS as well as Android and iOS;
- The web LMS should be accessed via the browsers and should support responsive design approach - equally accessible on all popular devices, browsers and screen sizes and resolutions;
- The physical data should be stored in the relational database RDBMS;
- The LMS should utilize communication with internal and external subsystems using the standard web interface to provide full information control and a more streamlined communication protocol;
- The RDBMS must offer user authenticated access to the well documented and described database (or databases) that will be open and accessible for the staff for additional queries and eventual services development.

Non-functional requirements play significant role in defining system architecture and are part of the technical specification.

### Product requirements

#### Usability requirements

The entire LMS must be web based where users will access with a standard web browser(s). It is a dynamic web site solution integrated with web services for interoperability with other internal and external systems. The application should be supported by the following browsers: Internet Explorer, Google Chrome, Mozilla Firefox and Safari.

#### External requirements

#### Documentation

The LMS must provide user manuals, technical implementation specification and help functionality.

The user manuals should contain two chapters – the first one covers detailed description on how to achieve certain functionality and the second one covers detailed description on user interfaces, including all menus, drop down boxes, selection items forms etc. There should be separate manuals for different users.

## 7. Platform deployment

The platform should be accessible through the ESSENSE project website [essense-project.eu](http://essense-project.eu). The diagram in Figure 12 describes the deployment implementation of the full platform and website system

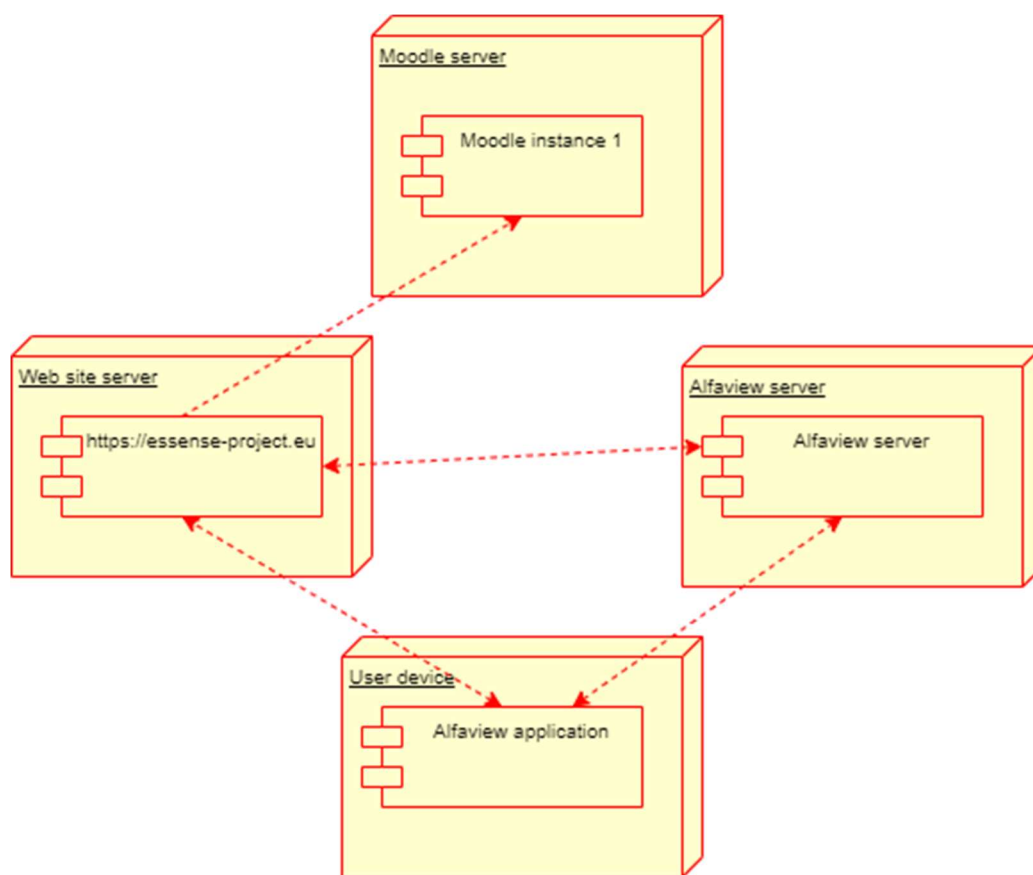


Figure 12 Learning platform deployment diagram

## 8. Conclusions

The Moodle platform confirms to all the requirements stated in the Joint curriculum and the Educational Philosophy defined in the ESSENSE project. Furthermore, it is easily customizable and extensible. There are wide varieties of plugins that can be easily installed and configured and that don't require any software development knowledge. As the technology is rapidly changing, these features would allow the platform administrator to modify or install new plugins that would be more suited for the new requirements in the future. For the current curriculum, the Moodle platform and the alfaview plugin cover all the requirements set for the implementation of the ESSENSE course curriculum.

## References

- [1] Moodle documentation, <https://docs.moodle.org/>, (Last accessed 2020-06-30)
- [2] Content packaging specification, [www.imsglobal.org/content/packaging/index.html](http://www.imsglobal.org/content/packaging/index.html), (accessed 2020-07-10)

