D2.1 SPECIFICATIONS OF FAB VLE

WP2 Design of the FAB MS Curriculum & Development of the FAB VLE

Project Information

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Table of Contents

List of figures

List of tables

Executive Summary

This report defines the technical and contextual specifications for the FAB Virtual Learning Environment.

Contextual requirements concern the key features of the FAB Virtual Learning Environment, including building blocks of the FAB Professionals/VET courses (MOOCs) architecture, course structure, assessment and certification, collaborative mechanisms, users' communication, accessibility, roles and enrolment.

Technical requirements concern the software specifications of the Virtual Learning Environment, including IT architecture, software components, installation prerequisites, software prerequisites, course content format and specifications.

1. Introduction

The objective of this report is to present the contextual and technical requirements for the design and development of the FAB Virtual Learning Environment. The FAB Virtual Learning Environment follows the latest technology in Online Training to allow for the collaborative interaction between its users through both learning and assessment activities. The FAB Virtual Learning Environment will be linked into the project website https://fab-project.eu/.

1.1 FAB objectives

The FAB project is an Erasmus+ KA2 Capacity Building in the field of Higher Education that aims to develop a MSc. program in Family Business Administration in order to address the unique challenges that family businesses in Cambodia, Malaysia, Philippines, Bangladesh, Bhutan, Nepal face and hamper their growth and development.

The FAB project develops a new master's degree in Family Business Management supported by a VET professional training course, six centers of excellence that promote cooperation, innovation and career development and a VLE consisting of an Academic Space, a Virtual Library and Massive Online Open Courses.

A learning outcomes approach is followed that will reflect the context, scope and content of the programme and will be linked with appropriate learning activities, assessment methods and assessment criteria.

The FAB MSc. programme will apply know-how, best practices and processes from European HEIs, namely Portugal, Greece and Cyprus, thus filling the academic gap and addressing the regions business needs and demand for specialised personnel. The FAB MSc Programme aims to :

- Develop new specialized curricula and an innovative MSc. programme in Family Business Management, thus helping build the capacity of the partner countries'(PC) HEIs, improve the level of competences and skills offered, and address the existing absence of a similar programme. The consortium will also research and formalise the design of multi-stage, mixed model MOOCs for Family Business professional courses, including non-formal and informal learning.

- Establish viable synergies and links with the regional family business sector in order to address their needs in terms of required professional skills in the field of entrepreneurship and family business management, training needs and enhance the employability of graduates.

- Reinforce the capacity of the PC HEIs by training their academic staff in the new courses and appropriate delivery methods. This will be achieved by organising study visits to EU HEI and capacity building training workshops in each PC as well as developing a training Virtual Learning Environment (VLE) to support the PC HEIs' academic staff during and after the project.

- Reinforce the infrastructure of the PC HEIs by establishing 'Family Business Centers of Excellence' that will act as foci for research and innovation in the area, thus ensuring that family business education will remain high in the regional priorities agenda for a long time after the project has been completed. The 'Family Business Center of Excellence' will promote entrepreneurial behaviour (including

innovation) in existing family firms. It will act as a 'family business contact point' at national level and will promote better dialogue between the family business sector and the government and help convey the concerns faced by the sector into policy consultation processes..

1.2 Scope of the FAB VLE

The FAB VLE will consist of the following 3 different sections:

EFAB Academic Space: This space will be designed for the academic staff of Asian HEIs, to enhance their teaching skills, by introducing them to modern curricula concepts and methodologies guidelines, as well as ECTS/ESG application guidelines. It will offer an open online course, based on the content of D2.2 Handbook on curricula development & ECTS/ESG and D2.7 Teacher's guide, for the training of the academic staff of Asian HEIs.

FAB Master's programme Virtual Library: This space will be designed for the students of the FAB Master's programme. It will be an OER space, freely accessible with material relevant with the FAB course's scientific foci. It will include courses syllabi, textbooks, journal articles, policy papers and analyses, conference presentations, video and audio material, links to journals and other related initiatives, relevant EU best practices and case studies, assessment exams and cases studies. It will act as a cooperation and support portal during the delivery of the FAB Master's programme.

FAB professionals/VET courses (MOOCs): This space will be designed for family members, owners, staff and policy makers as well as anyone wish to learn how to navigate and manage the family firm context. Six (6) MOOCs will be created, tailor made to the training needs of the family businesses and the special characteristics of each consortium country: one for Cambodia, one for Malaysia, one for Philippines, one for Bangladesh, one for Bhutan and one for Nepal. As the course progresses, a distinction will be drawn between family members, owners, staff and policy makers.

The VLE will implement the FAB pedagogy, based upon collaborative learning approaches, allowing the collaborative interaction between the trainers and the learners - trainees. For this purpose, the training will include a virtual community, where users will be able to meet, exchange experiences, and participate in group activities through discussions forums.

The FAB VLE will offer the relative training and learning resources freely and openly for educators, students and self-learners for use, reuse, adaptation and sharing. Constraints imposed will be related to the commercial reuse of the material as well as giving appropriate credit and license when reusing the material. Thus, the resources will be released under the Creative Commons licenses. The exact configuration (NonCommercial, ShareAlike, etc) will be defined by the FAB consortium. All resources will be made available in downloadable and editable formats so that the user can store them locally and access them when offline (such as text documents, presentations, and videos). The quality of these open educational resources will be assured based on OER commons recommendations, as well as the EU Open Education 2030 vision on lifelong learning.

The consortium will examine exploitation potential after the project lifetime, which will turn the FAB courses into a commercially viable value in order to enhance the long-term sustainability of the project. This will be done on the basis of a commercial and IPR agreement between all interested partners, thus safeguarding the coverage of the costs after project end ensuring the long-term sustainability of our project.

1.3 Target Groups

The direct users of the FAB VLE are:

- Academics staff from Asian HEIs
- Students of the FAB MSc programme
- Representatives of the regional industry and individuals

2. Learning Management System

2.1 Comparative analysis of Moodle & Open edX

A comparative analysis of the main characteristics of the most used open access learning platforms, Moodle & Open edX was performed and the main findings are presented below:

- Open edX is specifically designed for the MOOC world of online and self-paced learning and caters nicely to larger-scale audiences, wherein the platform can easily scale from a few learners to a millions of learners. On the flip side, Moodle is built for a more traditional online classroom model, where online classroom sizes would typically range between 5-30 students.
- Students in the Open edX environment in comparison with Moodle LMS are more active[1]. The MOOC-style setup of Open edX enables more interactive participation than a simple online classroom. Open edX technology allows instructors to create engaging learning sequences, which promote active participation as students alternate between learning concepts and solving simple exercises to check their understanding. The course content is presented through learning sequences: a set of interwoven videos, readings, discussions, wikis, collaborative and social media tools, exercises and materials with automatic assessments and instant feedback.
- Generally, both platforms are rich in multimedia features, but Open edX is superior because it offers more options for the video content and offers interactive learning tools. The Open edX video player, which is based around YouTube's embeddable video player, is excellent, as: custom extensions to this player allow students to follow click-on transcripts to move along the video, adjust video speeds, download both the video and the transcripts, and even view transcripts in other languages.
- Open EdX is also superior in terms of evaluation techniques because of the automatic grading system for grading essays. Overall, it seems to also give a greater importance to the assessment process than Moodle, by developing new methods of giving feedback to students and tracking their performance.
- Both Moodle and Open edX offer decent communication tools such as discussion forums.
- Community is an important part when choosing an open-source application. Both platforms have different but active communities that drive the direction of platform development. The Moodle community grew out of its base of K-12 education, whereas the Open edX community emerged from higher education with the idea of sharing more complex and advanced information via MOOCS.

Summing up, Open edX offers a modern approach which can handle massive concurrent participants while Moodle provides more traditional classroom teaching approach. This is in in line with the FAB partners' lecturers' experience of delivering massive open online courses. Thus, the most appropriate LMS to be used is open edX.

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[1] Zagorskis, V. and Kapenieks, A. Impact of LMS Selection on Students' Activity - Students' Activity Evaluation Problems in Moodle and Open edX Learning Management Systems. In Proceedings of the 10th International Conference on Computer Supported Education (CSEDU 2018) - Volume 1, pages 505-512 ISBN: 978-989-758-291-2.

3. Contextual requirements of the FAB Online Training Platform - MOOCs

The FAB VLE will be tailored to the training needs of the FAB target groups. It will take advantage of the Open edX platform capabilities. Since Open edX is an open-source LMS, it will be modified to meet any specifications necessary. The core features of the FAB VLE are presented below.

3.1 Modularity

The main difference between an online course and a campus class is that instead of hour-long lectures, online classes are built up of many bite-sized components, such as, three to seven videos or individual exercises. These components are modular or stand-alone since modularity has many benefits. Learners can quickly find compactly organized reference information about a specific topic without having to scroll through a bunch of texts or scrub through an hour-long video to find the one piece of information they were looking for.

Learning modules are organized so that learning material (e.g. video modules / reading material / PowerPoint presentations) alternate with exercises. This will also allow editing, reorganizing, replacing or improving the modular course content or exercises because it minimizes the impact on adjacent material.

In this context, the content structure includes the following building blocks:

- The course outline is the container for all the course content. The outline contains one or more sections.
- Course **sections** (Modules/Weeks) are at the top level of the course and typically represent a time period. A section contains one or more subsections.
    - Course **subsections** (Lessons) are parts of a section, and usually represent a topic or other organizing principle. Subsections are sometimes called "lessons" or "learning sequences". A subsection contains one or more units.
    - Course **units** are lessons in a subsection that students view as single pages. A unit contains one or more components.
    - Course **components** are objects within units that contain the actual course content: Videos, reading material, problems/quizzes and discussion forums.

The following picture summarizes the content display flow. When published, the content is available online. Graded assignments and problems are located in the subsection level.
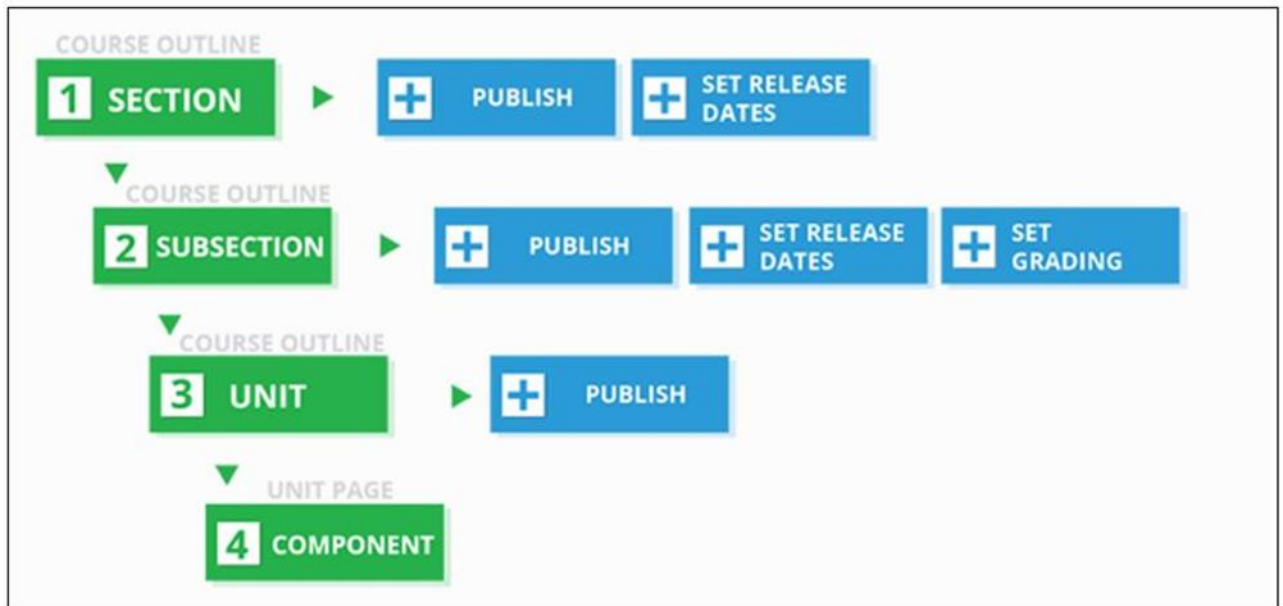
Figure 1 Course Outline

The template for developing the FAB building blocks is presented in Annex 1

3.2 Accessible Content

The FAB VLE will make the FAB courses available to representatives of the regional industry from diverse backgrounds with varying levels of skills and abilities. In this context accessibility refers to the degree to which information and activities are available to all learners equally regardless of physical or other disabilities. The FAB VLE will create accessible digital learning content, which conforms to level AA of the World Wide Web Consortium's Web Content Accessibility Guidelines (WCAG) 2.0.

The following best practices will be taken into account to make the content accessible:

- Help the representatives of the regional industry who use screen readers through the use of descriptive titles in the course content.
- The content will be structured with HTML elements or textbooks that should follow the accessibility guidelines presented in the following section.
- When using images, charts or diagrams, color will not be used as a distinguishing element in the image, chart or diagram.
- FAB will use high resolution images that always include descriptive, alternative text.
- All FAB courses will use videos with interactive accessible transcripts.
- Any external content or content that requires plug-ins, will be accessible.

3.3 Textbooks and PDF Accessibility guidelines

Portable Document Format (PDF) is a common format for course materials, including textbooks. However, converting materials to PDF documents can create accessibility barriers, particularly for learners with visual impairments. Accessibility issues are very common in PDF files that were scanned from printed sources or exported from a non-PDF document format. Scanned documents are simply images of text. To make scanned

documents accessible, Optical Character Recognition (OCR) should be performed on these documents and proofread the resulting text for accuracy before embedding it within the PDF file.

Also, semantic structure and other metadata (headings, links, alternative content for images, and so on) should be added to the embedded text. When exporting documents to PDF from other formats, it is important to ensure that the source document contains all the required semantic structure and metadata before exporting. The following Best Practices for Authoring Accessible PDF Documents will be followed:

- Explicitly define the language of the document so that screen readers know what language they should use to parse the document.
- Explicitly set the document title. When a file is exported to PDF format, the document title usually defaults to the file name, not a human readable title.
- Verify that all images have alternative content defined or are marked as decorative only.
- Verify that the PDF file is "tagged". Make sure the semantic structure from the source document has been correctly imported to the PDF file.
- Verify that a logical reading order is defined. This is especially important for documents that have atypical page layouts or structure.
- If the document includes tables, verify that table headers for rows and columns are properly defined.

3.4 Mobile learners

In general, the percentage of learners who access online courses through smartphones is constantly rising. It is expected that an important percentage of the FAB registered users will perform part of their learning activities though their smartwatches of mobile devices. Having this in mind the following best practices will be employed:

- Implementation of a custom theme (branding, colors, fonts, buttons) to support registering, enrolling and performing learning activities. The theme must be responsive and able to display content in displays with different size.
- Keep display names of sections and labels concise.
- Avoid if possible, learning material in Flash since mobile platforms do not support it efficiently.
- When needed, components in HTML will use relative rather than explicit sizes for objects so that they scale appropriately when viewed on displays of different sizes.
- Employment of mobile ready problem types.

3.5 Open access

FAB MOOCs will include lectures and assessments that are especially created for the FAB project. The project's educational resources will be offered freely and openly for educators, learners and self-learners for use, reuse, adaptation and sharing through the FAB VLE. There will be constraints imposed regarding commercial reuse of the material as well as giving appropriate credit and license when reusing the material. Thus, the resources will be released under the Creative Commons License. The FAB consortium will decide the exact configuration (NonCommerical, ShareAlike, etc). All resources will be made available in downloadable and editable formats so that the user can store them locally and access them when offline (such as text documents, presentations and videos). The quality of these open educational resources will be

assured based on OER commons recommendations, as well as the EU Open Education 2030 vision on lifelong learning.

Additional, pre-existing resources can be included, such as published textbooks or articles. These educational materials can be incorporated into the FAB MOOC, provided that copyright laws and regulations are respected.

Finally, the consortium will examine the possibility to apply fees for the online courses after the project lifetime, which will turn the FAB VLE courses into a commercially viable value in order to enhance the long-term sustainability of the project. This will be done on the basis of a commercial and IPR agreement between all interested partners, thus safeguarding the coverage of the costs after project end ensuring the long-term sustainability of our project.

3.6 User Navigation

Course description page

To get the word out about the FAB MOOCs an About page will be initially created. The About page will be the website where the platform users will come to register and will serve as an advertisement of the FAB courses. It can include texts and short videos (no longer than 3-5 minutes) describing the course content, introducing the course staff and stating the learning objectives of the FAB courses in a general and succinct way.

This page will be published several months before the FAB courses begin.

The set of introductory materials that learners can view when they first enter a course are presented in ANNEX 2.

Registration

The FAB platform supports the registration function. Each user needs to create an account and verify it through a confirmation email on the email address used. Upon verification the user is able to log in /sign in to the FAB platform. The FAB platform will link to the online user manual of the platform facilitating the user in managing his/her account and acquire information regarding the foreseen learning activities.

Learning Sequence

FAB training content includes a variety of material, from FAB syllabus and schedule to FAB course handouts. The majority of the FAB training content consists of courseware and the teaching and assessment material developed throughout the project. Courseware can may include videos, slides, readings, exercises, quizzes/tests and case studies. This content will be placed in the Course tab of the FAB Online Training Platform.

Courseware will be organized in sections. When a learner selects a section, he/she will be able to drill down further into subsections. When a learner selects a subsection, he/she will see a learning sequence, a sequential list of course units across the top of the screen in the Course ribbon.

Learners will engage with content as they move through the units in the learning sequence.

The learning sequence will be designed to engage the learner by creating a modular experience to navigate through. Learning sequences promote active engagement as students are navigating between learning concepts and solving simple exercises to check their understanding.

A typical learning sequence has a video lecture with reading material followed by a quick exercise, then another video lecture with reading material, and another exercise, and so on
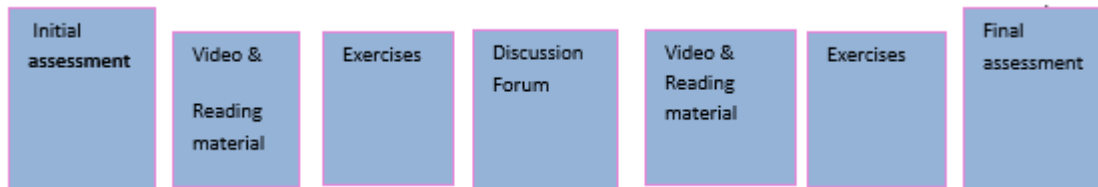

Figure 2 FAB MOOC learning sequence

This active-learning method enables learners to apply what they've learned from the videos and the reading material before moving on to new material. The videos and reading material included in the learning sequence will cover the important ideas, relevant questions, issues, and problems that are at the heart of the FAB training material. In order to make the learning sequence engaging the video content will be split into small, bite-sized elements and inter-weaving meaningful exercises, or other interactive experiences, to follow them. The videos will be 5 minute- to 10 minute- long and as modular or standalone as possible.

A discussion topic will be inserted after each module (video, reading material and exercise) so that learners/trainees can discuss the material with other who have also recently gone through this material. This "local" discussion topic, embedded in the learning sequence, will also appear in the course discussion forum.

The FAB VLE will offer a variety of exercises from basic multiple-choice questions, to drag and drop exercises that are especially geared towards an online audience. The platform will even offer advanced exercise environments like real case studies. All of these problems can be automatically graded and will have customizable features. For example, learners will be allowed to have multiple attempts before they submit their responses or will be shown the answer, or a hint, after several attempts.

Discussion Forums

Course discussions will be an integral part of the FAB MOOCs. Through course discussions, learners will share their opinions and ideas, engage in conversations with other learners, ask questions of the course staff and comment on the various components of the course. The vision for the learning community in the FAB MOOCs is to bring together representatives of the regional industry (and in particular of the Manufacturing, aerospace, automobile and engineering sectors) from all partners' countries and beyond and to be sustained long after the end of the project. It will include a diversity of perspectives, interests, and background knowledge and will allow learners to benefit from this diversity.

During the lifetime of the project, discussion components will be added directly into a unit, allowing learners to respond to the content introduced in the unit. Learners will be able to view and access all of the course discussions in the "Discussion" tab in the navigation bar.

Discussions will be moderated by the FAB consortium. Each partner will appoint one person as discussion moderator, who will be responsible for the active upkeep, for example keeping an eye on discussions in order to alert the trainers of particularly interesting conversations.

When using course discussions, learners will be able to:

- create new discussion posts, reply to existing posts, comment on existing responses, and upvote posts and responses;
- filter and sort posts by various criteria, including posts with the most votes or with the greatest level of activity;
- search on discussion forums by keyword;
- receive an email message each day that summarizes discussion activity for the posts they are following.

Discussion moderators can perform the same tasks as learners, but in addition they can:

- edit, delete or close posts;
- pin posts so they appear at the top of the discussion;
- add more discussion moderators to the course team.

Types of problems/assessments

The FAB VLE can provide many different types of questions, exercises and feedback options that can be used when designing the exercises for the FAB courses:

- Multiple choice/Checkbox/Dropdown questions: They have a limited number of possible answers and can allow learners to quickly check their understanding in the middle of a learning sequence.
- Image mapped input/Drag and drop problems: Assessments with graphical components can link learners more closely to the material while still allowing them to choose from a finite set of possible answers. Image mapped input (pointing on a picture) and drag and drop problem types allow learners to interact directly with a graph or picture.
- Problem types that prevent random guessing are a powerful tool combined with automatic grading. Text input (fill-in-the-blank) and numerical input (enter a number) problems can allow an unlimited number of tries without guaranteeing a correct answer.
- Math expression input problems prompt learners to understand the relationship between values instead of focusing on calculating the final result.
- Open Response Assessment (ORA) problems allow instructors to assign questions that may not have definite answers or may be too lengthy for instructors to grade at scale. ORA's can be designed in three ways: as a Peer Assessment, Self-Assessment, or for Staff Assessment. Learners submit a response to the driving question, and then that learner and the learner's peers compare the response to a rubric that you create. Learners can submit text responses, or you can allow them to upload an image to accompany the text.
- Peer Instruction provides students with in-class opportunities to discuss questions and arrive at a deeper understanding of concepts. The peer instruction tool emulates this classroom experience for the learners in an online course.

Some or all of these exercises will be auto-graded on the FAB VLE, so as to allow learners to receive instant feedback. Also, they will give allow learners multiple attempts, including hints, and writing detailed solutions so as to increase the effectiveness of feedback. Studies have shown that this kind of rapid feedback has

significant and positive effects on learner performance when compared to assessments without instant feedback.

Passing a Course and verified certificates

Each course may have its own passing score. Learners can see where those cut-offs are by looking at the vertical description in the Progress tab. Learners will receive a certificate once they have achieved the passing score. They will be able to download the FAB professional certificate from the Progress page, or their dashboard on FAB VLE. Every verified certificate will come with a unique URL, which learners/trainees can include on their resume or LinkedIn profile to confirm that they passed the course.

3.7 Instructor Functionalities

Instructor Dashboard

The Instructor Dashboard of the FAB VLE will be included in a special staff -trainers only tab in the navigation bar. Learners will not see the Instructor Dashboard listed in their course navigation. This tab has two main purposes: to show instructors information about student grades and enrolment, and to help them manage the course team. To put it simply, anything administrative that an instructor would do for a normal in-classroom course, can be performed on the Instructor Dashboard.

- Using the Instructor Dashboard, instructors, and other course staff can perform many different administrative tasks including the following:
- Access learner grades and records.
- Correct grades and perform other grading tasks. For example, download a spreadsheet (.csv) file that contains a breakdown of all of the grades for FAB enrolled learners.
- Access learner enrolment data.
- Enroll and disenroll learners, or close course enrolment.
- Email every enrolled learner in the FAB course.
- Assign specific roles to course team members including discussion administrators and beta testers.

Analytics

The FAB VLE will provide information about courses available to course team members who have the Course Staff or Instructor role. The FAB VLE will provide these course team members with data about learner backgrounds and activities throughout the course. The FAB VLE will provide intelligent, learner-centric analytics to help instructors understand how learners engage with course material.

The Analytics Dashboard will track learner enrolment and student engagement.

Enrolment. The Enrolment tab will include the total number of learners enrolled in the course, the number of new learners who enrolled in the previous week, a demographic breakdown of learner age, gender and education level, and a geographic breakdown of the learners enrolled in the FAB course.

Engagement. The Engagement tab will report the total number of active learners in the past week, as well as the number of learners who viewed videos and attempted to answer problems in the FAB course

CMS – Course authoring tool

The CMS is the course authoring tool. The developing of the structure and the content is taken place through this online tool. The CMS is accessed by the Staff members. Apart from the content creation, the CMS provides functionalities regarding important dates, configure certificates and defining the grading policy. Any of the out of the box problems, such as multiple-choice problems, can be graded or ungraded. The FAB course team will have complete control of what type of graded exercises the FAB courses will have, how much exercises count towards the final grade, and when they are due. The instructor dashboard will provide a source for tracking learners' progress.

Concerning the grading policy, the FAB VLE will give instructors considerable control over the exact nature of the grading policy. Instructors will be able to adjust grade ranges, change the names of grades, and decide on the number of possible grades. It is important to note though that any learner earning a grade over the "F", or "Fail," threshold will qualify for a certificate. This will be true regardless of how many grade levels will be add in the grade range. Thus, when establishing the FAB grading policy it is important to consider where to set the bar for receiving a certificate

Roles

Staff (Instructor) / Trainer.

Team members with the Staff role can complete the following tasks:

- View the course before the Course Start Date.
- Enrol and disenroll students.
- Access student grades.
- Reset student attempts to answer a question correctly.
- See course HTML errors.
- Send email messages to course participants.

Administrator.

Team members with the Admin role have access to all of the same options for running the course as team members with the Staff role. They can also complete the following tasks:

- Add and remove Staff.
- Add and remove other Admins.
- Add and remove Beta Testers.
- Add and remove Discussion Admins, Discussion Moderators and community Teaching Assistants (TAs-see below)

Discussion moderator.

While course discussions can contribute tremendously to the student experience, there are numerous reasons why it is important that the FAB course team maintain a constant presence in the discussions throughout the duration of the course.

- First, moderators should enforce the Discussion Guidelines and edit or remove offensive or inappropriate content, ensuring that the discussions provide a positive and respectful environment for learner interaction.
- Secondly, moderators answer questions posed by students regarding course content or structure and reply to suggestions or complaints about the course. No issues should go completely unaddressed—even a simple acknowledgement that an issue can only be fixed the next time the course is offered is better than no reply. Learners want to be heard and to understand why things are done the way they are; they always appreciate when the course staff is responsive to their needs and suggestions.
- Third, moderators can help foster vibrant and active discussions by replying to interesting posts, thanking or congratulating particularly active or insightful discussion participants, posing thought-provoking questions, and pinning or highlighting insightful discussion threads.
- Lastly, moderators can identify learners who are especially active in the discussions and invite them to become community Teaching Assistants (TA). As community TAs, these learners are very helpful to their peers and find the experience very rewarding.

In brief, FAB course team will spend a significant amount of time in the course discussions, as this is a great place to communicate with learners and ensure they have an excellent experience.

Beta Tester.

Beta testers have early access to the course. Beta testers are not members of the course team: they do not have information about "how it is supposed to work". They use their own computers and Internet connections to view videos, follow links, and complete problems. They interact with the course as learners will to find, and make, mistakes.

However, beta testers are not the same as other learners in the course, either. They have privileged access to the course and have more time to review and complete the course materials than the enrolled learners do. Course discussions are not open before the course start date, so beta testers cannot participate in community conversations. As a result of these differences, beta testers do not receive certificates when they complete a course.

The FAB course team can provide valuable feedback about the FAB courses. However, they are typically stakeholders in the success of the courses and have a significant amount of knowledge about it. As a result, they can be too close to the course to interact with it in the same way as learners will.

If a team member will be a beta tester, it should be noted that the privileges of the Staff or Admin role override those of a beta tester. The team member must use a different, second email address to create an additional edX account and enrol in the course, and the course team must assign only the beta tester role to that edX account. The course team member experiences the course as a learner only when she signs in to edX using the beta tester account.

The FAB MOOC development checklist

An important tool for the FAB MOOC team is the FAB MOOC Development Checklist (FAB MDC), which is available in Appendix 3. FAB course teams will use the FAB MDC to guide their course planning and creation

efforts as well as to determine if their course is ready to be offered on the FAB VLE as a MOOC. The FAB MDC includes a list of minimal requirements that a course must meet before being launched, as well as a list of optional best practices. The FAB MDC addresses the following areas:

- Course announcement and introduction
- Course structure
- Instructional materials and assessments
- Course administration and learner engagement
- The checklist is also available as a course handout.

While the FAB MDC can be viewed as a final checkpoint for the FAB course before it is launched, it should be consulted throughout the process of designing and creating a course.

4. Technical Specifications – System description

4.1 Platform Architecture

The centerpiece of the FAB VLE is the Open edX platform (https://github.com/edx/edx-platform), which contains the learning management and the course authoring applications (LMS and Studio, respectively). This service is supported by a collection of other autonomous web services called independently deployed applications (IDAs).
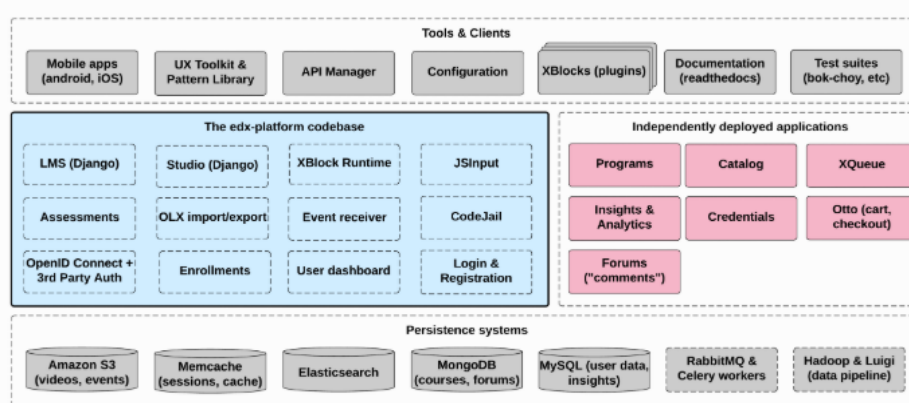

Figure 3 FAB Virtual Learning Environment architecture

Almost all of the server-side code in the Open edX project is in Python, with Django as the web application framework. A number of other repositories are also included, that can be used off the platform to integrate machine learning and analytics.

The Django server-side code in the LMS and elsewhere uses Mako for front-end template generation. The browser-side code is written primarily in JavaScript with some CoffeeScript as well (edX is working to replace that code with JavaScript). Parts of the client-side code use the Backbone.js framework, and edX is moving more of the code base to use that framework. The FAB online training platform uses Sass and the Bourbon framework for CSS code.

Course discussions are managed by an IDA called comments (also called forums). Comments is one of the few non-Python components, written in Ruby using the Sinatra framework. The LMS uses an API provided by the comments service to integrate discussions into the learners' course experience.

The comments service includes a notifier process that sends learners notifications about updates in topics of interest.

Events describing learner behaviour are captured by the FAB analytics pipeline into an SQL database. In addition, the system uses data related to course structure from a schemeless database (MongoDB) and storage tables from the Django Python Web Framework. The data for users is gathered during the registration on the platform and course enrolment and from interaction with the platform (video streams, problems submission, discussion posts, etc). The results are made available via a REST API to the front-end through a user-friendly GUI allowing instructors and administrators to know what their learners are doing and how their courses are being used.

Expandability

FAB Open edX courses are composed of units called XBlocks. Anyone can write new XBlocks, allowing educators and technologists to extend the set of components for their courses.

In addition to XBlocks, there are a few ways to extend course behavior:

- The LMS is an LTI tool consumer. Course authors can embed LTI tools to integrate other learning tools into an Open edX course.
- Problems can use embedded Python code to either present the problem or assess the learner's response. Instructor-written Python code is executed in a secure environment called CodeJail.
- JavaScript components can be integrated using JS Input.
- Courses can be exported and imported using OLX (open learning XML), an XML- based format for courses.

a. Installing the FAB online training platform

Open edX is a large complex system driven by the edX community. It is important to select the appropriate version and installation method. Regarding the version, there are two options:

- Select a <u>Master</u> version, which is the latest version of the edX code.
- Select a Release version, which is a marked and tested for wide use version. These versions are named alphabetically for trees: Gingko, Hawthorn, Ironwood, Juniper, etc. The updated catalog of the available open edX releases can be found at https://edx.readthedocs.io/projects/edx-installing-configuring-and-running/en/latest/platform_releases/.

The available installation methods are:

- **Devstack**: useful if you want to modify the Open edX code. For Hawthorn and above, devstack is based on **Docker**.
- **Native**: Automated installation on an Ubuntu machine of your own. Details are on the Native Open edX platform Ubuntu 16.04 64 bit Installation page[2].
- **Manual**: you are on your own, using our scripts as a guide. Read the Native instructions to find the scripts to study.
- **Bitnami**: installable pre-packaged images for popular cloud platforms. Details are at the Bitnami Open edX page[3].

It is foreseen that the FAB platform will be installed through a docker-based distribution (most probably devstack) in order to facilitate deployment, customization, upgrading and scaling. The Release to be used will be based on a widely used and tested version. In addition, an analytics engine is going to be deployed in order to develop Analytics features in the FAB platform. The Analytics engine provides tools and services to modify

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[2]https://openedx.atlassian.net/wiki/spaces/OpenOPS/pages/146440579/Native+Open+edX+platform+Ubuntu+16.04+64+bit+Installation

[3] https://bitnami.com/stack/edx

the Open Analytics Pipeline and Data API and is the base for developing custom visualization pages and performance metrics describing user performance and engagement.

b. Content as XBlock

The XBlock specification is a component architecture designed to make it easier to create new online educational experiences. XBlock was developed by edX, which has a focus in education, but the technology can be used in web applications that need to use multiple independent components and display those components on a single web page.

FAB platform will be a XBlock compatible application. This means, that an XBlock developer does not need to download and run the entire edx-platform developer stack or to know anything about the technologies that edX uses to provide the XBlock runtime. Instead, XBlock developers writing with edX in mind can work from the xblock-sdk and deploy their work on any platform that is compatible with XBlocks.

In educational applications, XBlocks can be used to represent individual problems, web-formatted text and videos, interactive simulations and labs, or collaborative learning experiences. Furthermore, XBlocks are composable, allowing an XBlock developer to control the display of other XBlocks to compose lessons, sections, and entire courses.

The content of the FAB courses will be based on HTML and video independent components. Special focus must be given to Video components in terms of:

- Duration: Videos should be kept as short as possible. Learners are more likely to finish watching a video if it is no more than 3-10 minutes long.
- Subtitling: Media-based course materials help to convey concepts and can bring course information to life. All videos in FAB courses are required to include timed text captions in SubRip (SRT) format. The edX media player displays caption files in an interactive sidebar that benefits a variety of learners, including learners who are hard of hearing or whose native language differs from the primary language of the media. This built-in universal design mechanism enhances course's accessibility.
- Supported Video formats. The FAB MOOC will support videos in .mp4, .mpeg, .webm, and .ogg format. However, to help make sure all standard browsers can play the videos, FAB course team will use the **.mp4 format.**
- Posting the Video online. The Open edX platform does not come with a built-in streaming server. Thus, all video content will be streamed through an external streaming server and be integrated in the FAB platform. By default the open edX video player accesses the content through YouTube. In case YouTube is not available in all locations, another external streaming server will be employed with Amazon S3 infrastructure being the primary candidate.
- Recommended Compression specifications**.** The recommended specifications for the videos, which will be hosted to the FAB MOOC are the following:

Output	Publish to YouTube	Publish downloadable file to AWS S3
Codec	H.264 .mp4	H.264 .mp4
Resolution & Frame Rate (see note)	1920x1080, progressive, 29.97 fps	1280x720, progressive, 29.97 fps
Aspect	1.0	1.0
Bit Rate	VBR, 2 pass	VBR, 2 pass
Target VBR	5 mbps	1 mbps
Max VBR	7.5 mbps	1.5 mbps
Audio	AAC 44.1 / 192 kbps	AAC 44.1 / 192 kbps

Figure 4 Recommended specifications of the FAB video content

5. Conclusions

FAB online training platform will create an accessible Massive Open Online Course (MOOC) which integrates the FAB training units, based on the Open edX platform. It will allow the collaborative interaction between their users through interactive learning content, assessment activities and discussion forums. The online platform content will be monitored and kept up-to-date continuously.

Annex 1 – FAB VLE story board example

Structure & Contents

COURSE NAME (consisting of one or more modules)

Module Title – 1. XXX

Lesson	Unit name *	Comp Type	Title/Source description	Notes
[Lesson 1 Title]	Introduction	Video	[Title] 3 minutes short video addressing Video title …	
		Text	[Title] Full text or link to external doc	
	Lecture 1	Text	Title] -> Link to the file	

		Video	[Title] -> Link to the file	
	Lecture 1 part II	Text	[Title] -> Link to the file	
	Knowledge check	Text	Information regarding the assessment types	
		Prob	Number of MCQ, retry limit, feedback information	
	Discussion	Forum		
[Lesson 2 Title]	....			

You can treat unit as an independent webpage containing up to three learning components

Lesson	Unit name*	Comp Type	Title/Source description	Notes
[Title]	Introduction	Video	[Title] 3 minutes short video addressing Video title …	
		Text	[Title] Full text or link to external doc	
	Lecture 1	Text	[Title] -> Link to the file	
		Video	[Title] -> Link to the file	
	Lecture 1 part II	Text	[Title] -> Link to the file	

	Knowledge check	text	Information regarding the assessment types	
		Prob	Number of MCQ, retry limit, feedback information	
	Discussion	Forum		
[Lesson 2 Title]				

You can treat unit as an independent webpage containing up to three learning component

Annex 2 – Course information page

This section provides the general description of the course and lists all relevant information to the course. This information is <u>publicly available to any user</u> without having to register or enrol in the FAB platform.

- General information about the course.
    - Estimated effort, language, course type (self-paced or instructor-led)
    - Social media links
    - Prerequisites
    - Learning objectives
- A Syllabus. A syllabus is an outline and summary of topics to be covered in a course. As with an on-campus course, a syllabus may include:
    - Topics covered by the course.
    - Names of instructors and teaching assistants for the course.
    - A grading rubric.
    - Textbook information.
    - Assignments that the learners can expect.
    - Deadlines and important dates.
    - quizzes/tests and topic coverage for tests.
    - Any additional information, such as information about course discussion sessions.
- Staff biographies.
    - Staff biographies for the course About page may include the following information.
    - Name
    - Title
    - Email address
    - Biography (1-2 paragraphs)
    - Image. Note: The instructor's image must meet the following requirements.
        - Resolution of 110 x 110 pixels
        - Under 256 KB in size
        - .gif, .jpg, or .png file type
    - Additionally, biographies can optionally includeFacebook, Twitter, blog URLs, and List of major works
- Frequently Asked Questions (FAQ).
    - Weblink to Open edX Learner's Guide FAQ that will help learners' transition to online learning. The guide answers common questions about topics like getting started in an online course, earning certificates, participating in course discussions, and completing some of the exercises you may see in your course.
    - Contact details of the technical support team

Annex 3- FAB MOOC development checklist

#		
2		
3	Welcome message	Yes
4	Demo of the platform if required	Not Applicable
5	Detailed explanation of how the student can get help if needed	Yes
6	**Course program**	
7	PDF of the program	Yes
8	prerequisites of the course	No
9	duration of the course	No
10	course deadlines and dates	No
11	Clear qualification policy	No
12	Learning objectives, goals and results	No
13	Accademic policy	No
14	guidelines for discussion forums	No
15	Instructor roles	No
16	Course launch date	No
17	Any unexpected change to the published content will be clearly communicated to the students	No
18	**Structure and design of the Course**	
19	Course design intersperses instructional content, such as videos and text with exercises	No
20	Course design is clear and consistent from week to week	No
21	**Evaluations**	
22	The course includes tasks, for example, exercises / tasks / questionnaires "	No
23	The questions and guidelines on allocation problems are clearly articulated	No
24	the deadline for the tasks is clear	No
25	**Course videos**	
26	The course includes original videos	No
27	Video quality and consistent and adequate audio levels	No
28	Scheduled subtitles for all videos and audio content	No
29	**Other Instructional Materials**	
30	All the images used in the course are of constant and adequate quality "	No
31	All content from third-party sources is integrated into the course material instead of being linked to another site, if applicable.	No
32	The content outside the platform is optional and it is clear that the link will take the students to a site outside the course and the platform	No
33	**Student's Commitment**	
34	A welcome message will be sent to the students about the start date of the course.	No
35	The emails will be sent to the students to communicate the launch of new content, provide updates on the course events, and so on at regular intervals throughout the course (recommended once a week)	No
36	A closing email will be sent to the students with the final details of the course near the end date of the course.	No
37	Students are encouraged to use the discussion forum to present themselves "	No
38	**Preparation of the certificate**	
39	All the certificate information is correct and has been loaded	No
40	The certificate templates have been reviewed by the course team and are approved to activate "	No
41	**Reuse**	
42	All IP problems are deleted for the course and are clearly documented	No

Table 1 FAB MOOC development checklist