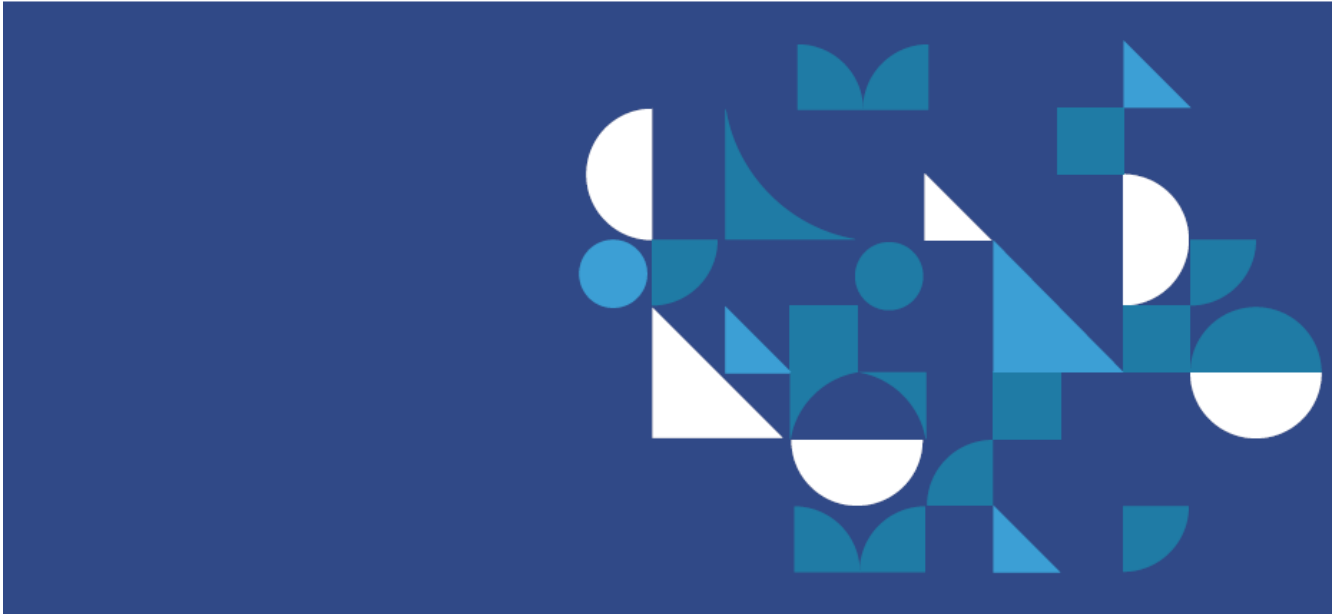




Industrial Engineering and
Management of European
Higher Education



Deliverable: MEMORANDUM ON TECHNICAL CRITERIA FOR THE DEVELOPMENT OF E-LEARNING MODULES AND REQUIREMENTS OF THE TECHNICAL ENVIRONMENT

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BOSCH



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Authors and contributors:

Joaquín Ordieres (UPM), Miguel Ortega (UPM), Miguel Gutiérrez (UPM), Gustavo Morales (UPM), Mercedes Grijalvo (UPM), Eduardo Caro (UPM), Javier Cara (UPM), Elcio Mendonça (UPM), Raúl Sanchís (UPM), Silvia Villalgordo (UPM), Giovanni Mummolo (POLIBA), Salvatore Digiesi (POLIBA), Francesco Facchini (POLIBA), Giorgio Mossa (POLIBA), Marek Fertsch (PUT), Agnieszka Stachowiak (PUT), Joanna Oleśków- Szłapka (PUT), Janerik Lundquist (LIU), Umberto Pascucci (VALUEDO), Alessandro Guadagni (VALUEDO), Felice De Stena (BOSCH), Hanna Golas (ALCO-MOT), Eskil Rehme (IMPLEMA), Carlos Urueña (ARRUTI)

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Introduction

UPM has elaborated the main technical requirements and features for both the e-learning modules to be developed by the partners and the environment where to store them are described.

Indeed, a common live-testbed for implementation has been provided with access rights to the partners according to their profile.

The document will also cover the ways for exchanging and deliver courses, by considering to deliver a Shareable Content Object Reference Model (SCORM) package. The alternative aims to provide the universities with a product easy to integrate in their running systems.

Technical requirements for e-learning modules

E-learning has become increasingly popular among learners and instructors today. Online courses are eliminating geographical barriers and spreading knowledge around the globe. A major reason for their popularity is the ability to engage learners. They can simulate classroom-like environments by allowing learners to easily interact with educators. E-learning has been able to redefine teaching strategies, as well, which has led to progress in the education sector.

All of this has been possible because of the advanced technologies that are being used in e-learning by both the content creators and the learners. Let's explore the technical requirements that are used in creating advanced level e-learning courses.

Besides the basic requirements of a computer and an Internet connection, e-learning uses a variety of different technologies. Some of them are specifically designed and developed for e-learning courses, and some are used for providing additional support and features for e-learning.

Creating videos and lessons: To create effective videos for e-learning courses, creators require good voice recording and editing software. They can record the voice using microphones and then enhance the quality with software. For example, software such as Audacity® can be used to enhance the voice quality and remove noise from the recording [1].

Instructors also might require screen recording software to capture the screen while teaching something. They can use video editing software to enhance their video quality, create videos with special effects, and add multimedia to videos. Camtasia® is one such software that can be used for this purpose. Content creators also can require scanners to scan content and utilize it in their videos and lessons.

Adding interactive elements: To amplify student engagement in online learning, it is important to add interactive elements to the course such as a comment or question feature; images and multimedia; and games, quizzes, and assessment tests.

Online course creators can use software such as PowerPoint® or similar tools to create amazing presentations or do storyboarding. Such software also can be used to include graphics and multimedia to enhance course content. Otherwise, dedicated graphics editing software such as Gimp®, Inkscape® can be used or course creators can use programming languages such as HTML, Java, and JavaScript to implement interactive elements in their course. Nowadays, instructors can use authoring tools or packages that are capable of doing all the coding required for an e-learning site. Instructors just need to place the elements in the correct positions and the background codes are generated automatically. Many online services nowadays can create and provide interactive elements for e-learning courses [2].

Communicating with learners: It is important to add a means by which students and instructors can communicate easily. Instructors can use e-mail or instant messaging software and create forums for their courses. They can use digital platforms such as Microsoft Teams® and Google Talk®, or Slack® to communicate in real time with learners. They also can use social media tools such as Twitter®, Facebook®, LinkedIn®, and YouTube® to provide a personalized learning experience .

Another important tool learners and instructors can use to connect and share information in real time is whiteboards. Whiteboard software allows screen sharing and brainstorming on problems together just like in traditional classrooms. Instructors also can use Google Docs to share course content and study material with learners. They also can use math/engineering software if required, which would allow them to easily explain such concepts [3].

Content management systems: A content management system (CMS) is like a database that is used by instructors to store their course content, multimedia, graphics, student records, and other important files. With the help of a CMS, instructors can easily manage their content and keep track of all the data related to their course. The CMS allows an easy search through all the content saved in it based on keyword search methods. Content creators or course instructors can navigate, add, update, and delete data with the help of the CMS interface. There are a number of open source e-learning CMS available to choose from [4].

Learning management systems: A learning management system (LMS) is the software that can be used to track and store user performance. It also generates reports for the same. For example, instructors can use an LMS to track how much time a learner spends on the course, and what content the learner has gone through and in how much time. It also can generate progress reports for learners by assessing them. Once a learner registers for the course, the LMS provides all the administrative facilities him or her. ELearning Industry has rated Adobe Captivate Prime®, Administrate®, and Moodle® as very relevant Learning Management Systems.

The technology used in e-learning is the major reason for the success of the learners and the course. Online course creators can use different software to enhance their courses and engage more and more learners. The main thing to consider is that the technologies used in e-learning should be able to satisfy the requirements of both the instructors and the learners [5].

To decide on the learning model which will be the best for implementing requirements, it requires to select between different alternatives, depending on the course configuration,

- **Pure eLearning.** learners are trained only online. They take courses and tests and read recommended articles and books.
- **Blended Learning.** Only a part of the training is transferred to online learning. For example, you can ask participants to complete all the prerequisite courses through eLearning and then undergo hands-on training in person.
- **Instructor-led training.** This type of training allows learners and instructors to interact and discuss the training material, either individually or in a group setting. Instructors may deliver training in a lecture or classroom format, or even virtually, using video conferencing tools.

Technical requirements for e-learning environment

The use of e-learning environments to support teaching and learning has had great impact on the way content is developed and managed. In most cases, both teachers and students have had to re-adapt the way they prepare, access and engage with educational matter. The adjustment in human mechanisms for organizing and interacting with educational content has become necessary due to

the re-mediation of established practices through the introduction of software-based techniques to structure content, for example, using metadata. Whilst metadata standards provide effective guidelines for organizing content in web-based e-learning environments, technology-based approaches to managing educational resources do not fully address social-cultural and pedagogical aspects of users in the context in which teaching and learning takes place [6].

Our e-learning modules run in a web browser and should work across most platforms. However, we have had to test against a standard office environment and can only guarantee that they will work on the following technical specifications:

PC minimum hardware specification

Platform: IBM PC Compatible

Processor: Pentium III or equivalent Processor speed: 2GHz RAM: 2Gb

Screen resolution: 1280x1024

Sound Card: Included with headphones as a minimum

Input devices: Mouse and keyboard

End user PC software specification

Operating systems: Windows 10

Browser:

Chrome > 92.0.4515

Firefox > 90.0

Brave > 1.28

Players and plugins: HTML5 compatible and video codecs

Other software: Adobe Acrobat or Foxit Reader for Windows

Assistive technologies: Jaws v 2020.2012.13 (for use with the text versions of the topics)

Connection/bandwidth

This course will be accessed across the internet by various users in various locations. As such, we cannot predict what their available bandwidth might be. We recommend that a broadband connection be used to access the course.

The video files are likely to be the largest files that the course will contain. To ensure they play satisfactorily, care will be taken to ensure the size and duration of these files is appropriate, and in most of the cases pointers to the video platforms themselves are given.

Screen resolution

The course is designed for a minimum screen resolution of 1280x1024. The course content will be better presented on higher resolutions and bigger displays, such as

- ☐ 20-inch screen (standard ratio): 1600 x 1200 pixels
- ☐ 22-inch screen (widescreen): 1680 x 1050 pixels
- ☐ 24-inch screen (widescreen): 1900 x 1200 pixels

Known issues

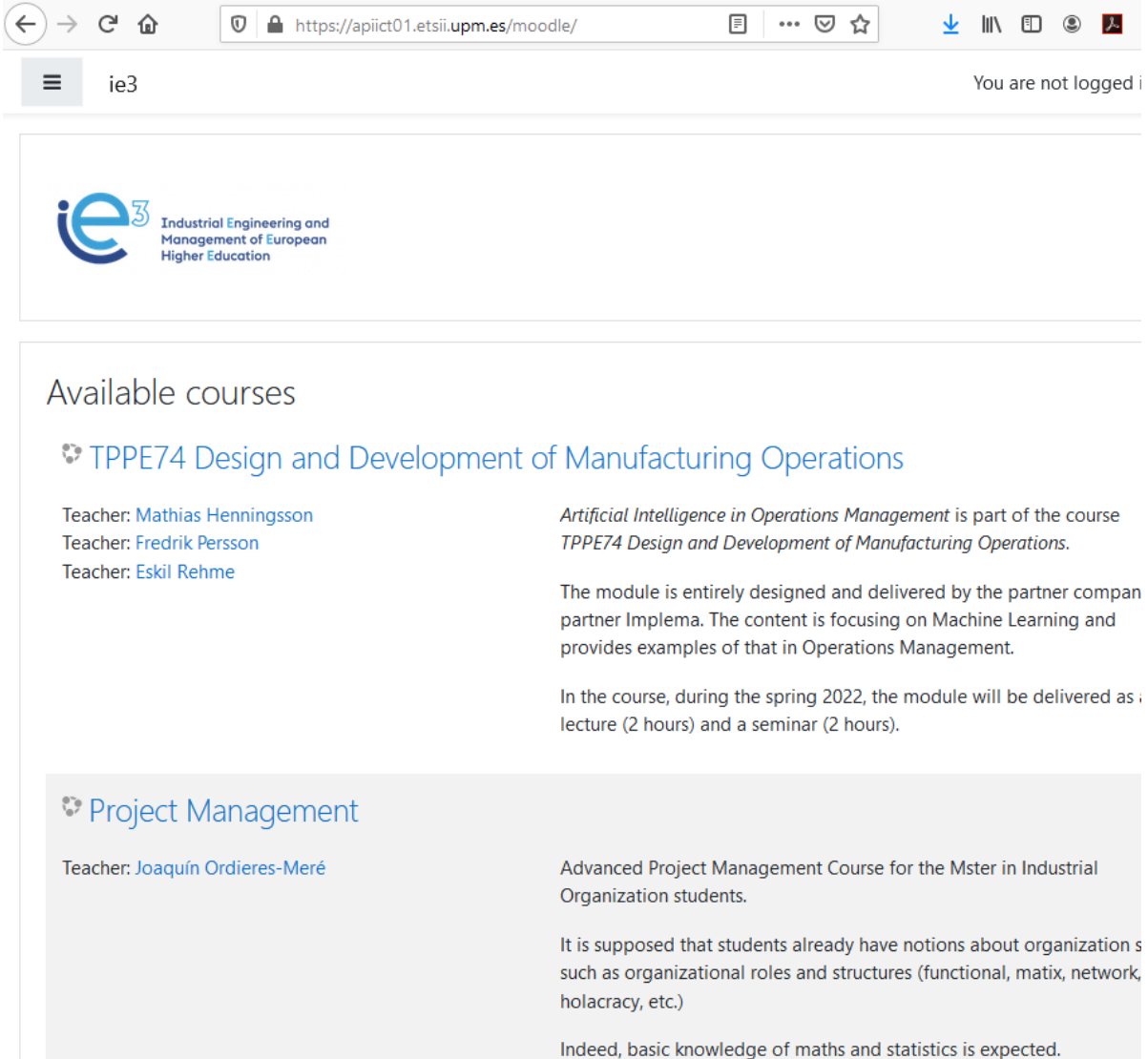
Issues can be experienced by running the e-learning modules with browsers that use pop-up blockers and with software such as Norton Security. As the modules could launch in a new browser window, these should be disabled while running the course [7].

Accessibility

Materials are provided in English and the usage of video platforms such as youtube® are promoted as they make an automatic translation of voice to subtitles for people with disabilities who wish to follow the content and who find such technology useful [8].

Live testbed environment provided

The UPM has requested specific technical and pedagogic requirements from the academic partners of the IE3 project. Indeed, a preliminary list of LMS was discussed at the beginning of May 2021 (T4.1) and the common decision was to use Moodle® as a convenient LMS, including some extra modules such as Competencies. The general appearance can be seen in Figure 1,



The screenshot shows a web browser window with the URL <https://apiict01.etsii.upm.es/moodle/>. The page header includes the logo for 'ie3 Industrial Engineering and Management of European Higher Education' and the text 'You are not logged in'. The main content area is titled 'Available courses' and lists two courses:

- TPPE74 Design and Development of Manufacturing Operations**
 - Teacher: [Mathias Henningsson](#)
 - Teacher: [Fredrik Persson](#)
 - Teacher: [Eskil Rehme](#)
 - Description: *Artificial Intelligence in Operations Management is part of the course TPPE74 Design and Development of Manufacturing Operations.*
 - Details: The module is entirely designed and delivered by the partner company partner Implema. The content is focusing on Machine Learning and provides examples of that in Operations Management.
 - Delivery: In the course, during the spring 2022, the module will be delivered as a lecture (2 hours) and a seminar (2 hours).
- Project Management**
 - Teacher: [Joaquín Ordieres-Meré](#)
 - Description: Advanced Project Management Course for the Master in Industrial Organization students.
 - Prerequisites: It is supposed that students already have notions about organization such as organizational roles and structures (functional, matrix, network, holacracy, etc.)
 - Expectations: Indeed, basic knowledge of maths and statistics is expected.

Figure 1.- Assessment Process Schema.

The Moodle site was established at Virtual Private Server apiict01.etsii.upm.es (IP: 138.100.82.171), where different courses were setup, including teacher registration with appropriate roles, in such a way they can start creating course content according to the topic and methodologies.

Characteristics for the VPS server are those reported in Figure 2 and Figure 3.

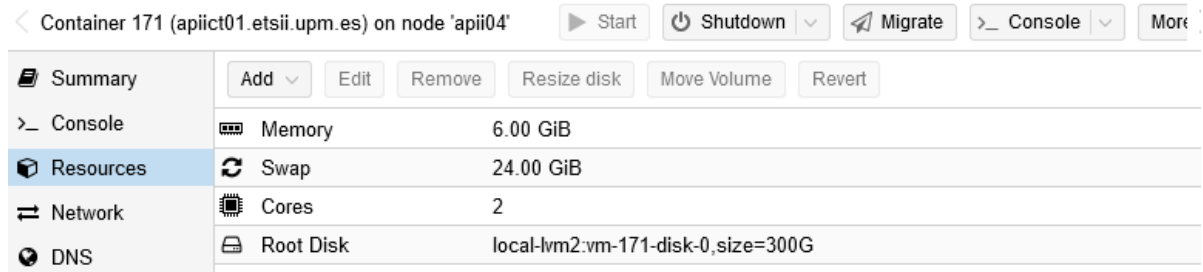


Figure 2.- VPS server characteristics

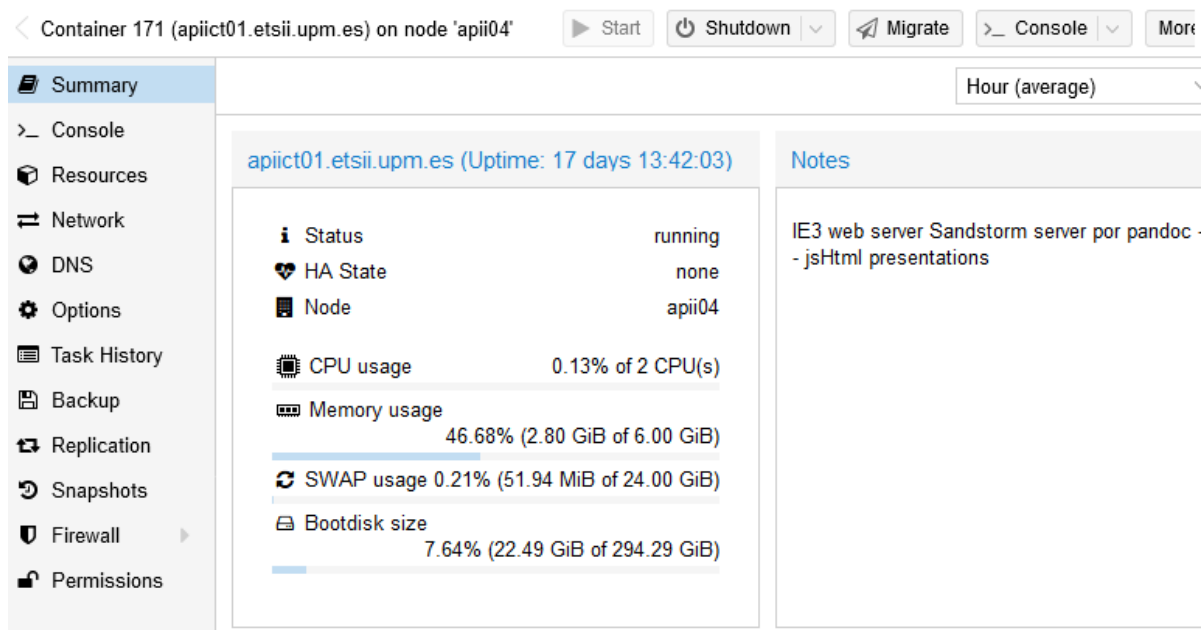


Figure 3.- Results retrieved from the process

As a matter of resilience to setup a backup server will be considered depending on the demand from course usage. An alternative solution is to enlarge the allocated resources to the apiict01.etsii.upm.es, also depending on its usage.

Ways for delivering courses

Different ways for delivering courses can be envisaged, depending on the pedagogical model each partner want to use. The alternatives under consideration are

- **Pure eLearning.** Mainly for self-guided workers as complements to the in-company continuous education.
- **Blended Learning.** Only a part of the training is transferred to online learning. This solution is going to be used by the UPM, where flipped classroom will be implemented with the LMS support and competence assessment. Practical activities will be carried out in face to face sessions. Other partners can choose this approach by embedding specific modules inside the course.

- **Instructor-led training.** This type of training allows learners and instructors to interact and discuss the training material, either individually or in a group setting. Instructors may deliver training in a lecture or classroom format, or even virtually, using video conferencing tools.

Different alternatives as well as mixing some of them have been enabled, bringing more flexibility to both, course creators and instructors.

Ways for exchanging courses

Course Exchange (CE) has two different meanings inside IE3 project. From one side it enables students, through their home institutions, to seamlessly access high quality online courses and programs offered by other project member institutions. The collaborative model fosters faculty engagement, resource sharing, and innovation. On the other side, a more software side approach has been enabled, allowing to export the course content and to translate the files to other site provider, saving the investment and learning carried out during the project execution.

Each member has a representative who serves on the Steering Board, the policy making body. It meets monthly by conference call (mainly throughout multimedia tools because of pandemic restrictions).

The future vision for Exchange allows members with extra capacity in online courses to make their empty seats available to other members. Students in the future could enroll in these courses at their home institution which has reserved these seats. Ways for transcription to the home institutions need to be further analyzed, while for the operating conditions inside the project local side-by-side agreements can be adopted.

Export components from a course offering to a file. This allows instructors to reuse these components in another Learning Environment, or to store the components and then re-import them into another course offering or template at a later date.

The copy components feature can be used to:

- Reuse course materials from a previous course.
- Add course materials created by colleagues into your own course offering.
- Set up standard course materials in a Master Course to copy into new course section(s) each semester.

Then, each course can be moved to individual backup file. When done it can be moved and restored totally or partially (see Figure 4).

Moodle does not generate scorm content. Moodle presents the content in SCORM packages to learners, and saves data from learner interactions with the SCORM package.

Some people hand-code SCORM objects using HTML, JavaScript, and sometimes SWF files. There are some templates provided by ADL and by others, which make this process easier.

Others use SCORM authoring software to generate SCORM packages. This process is easier for non-technical users, but not as foolproof. No SCORM authoring software is without bugs, and some have significant issues when used with Moodle. Just because products are listed on this page does not mean that Moodle.org either supports or endorses them. Be sure to test all products extensively before purchase, and be sure that the built-in Moodle authoring tools will not meet your needs.

Conclusions

The goals defined in task T4.1 have been addressed, as reported in this Deliverable. Mechanisms to increase resilience have been considered and extra modules for the LMS, such as competences and badges have been enabled.

Overview for the exchange processes have been also worked out to enable

apiict01.etsii.upm.es/moodle/backup/backup.php?id=2

Departament... Comunidad In... Librerias de es... Measuring Per... Genetic alg

ie3

MIO-DPHTA

Participants

Badges

Competencies

Grades

INITIAL

GENERAL

SCOPE

AGILE

PLANNING

COST

RISK

Dashboard

Site home

Calendar

Private files

Content bank

Site administration

Backup course: MIO-DPHTA

Dashboard / Courses / UPM / Project Management / MIO-DPHTA / Backup

1. Initial settings ▶ 2. Schema settings ▶ 3. Confirmation and review ▶ 4. Perform backup ▶ 5. Complete

Backup settings

- IMS Common Cartridge 1.1
- Include enrolled users
- Anonymize user information
- Include user role assignments
- Include activities and resources
- Include blocks
- Include files
- Include filters
- Include comments
- Include badges
- Include calendar events
- Include user completion details
- Include course logs
- Include grade history
- Include question bank
- Include groups and groupings
- Include competencies
- Include custom fields
- Include content bank content
- Include legacy course files

Jump to final step Cancel Next

Figure 4.- Configuration for backup a course / module.

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