Euro BioImaging
Preparatory Phase II Project

D7.6 Report on the implementation of an e-forum and online platform for initial and vocational training and exchange activities on the EuBI web-access portal

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Abstract

With the aim to prepare the implementation of an e-forum and future online platform for initial and vocational training and exchange activities on the EuBI web-access portal, WP7 proposes in this report a first framework with recommendations to carry out this task.

The present report constitutes the deliverable D7.6 of the Euro-BioImaging Preparatory Phase II project.

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1. Introduction and framing of Deliverable 7.6 within Task 7.3

Faced with the need to provide and facilitate education and training activities when key expertise is concentrated at relatively few training centres, and the education and training needs are quite widespread, the implementation of a virtual platform on the EuBI WAP and the integration of e-training to the EuBI training offer have been included to the roadmap of the Euro BioImaging Project Interim Operation.

Although the initial aim of this deliverable and related task (T7.3) was to report on the implementation of an e-forum and virtual platform on the EuBI Web Access Portal (WAP), it had to be redefined as the work to progress towards the implementation is still significant and will require additional resources that are not available during the Preparatory Phase II. It was thus decided by the partners (Executive Project Management conference call 6) to use this deliverable to report on the necessary preparatory work in order to prepare the design and implementation of an integrated virtual platform for initial and vocational training and exchange activities. This platform will be then hosted on the EuBI WAP.

The two main objectives of the EuBI virtual platform will be to:

- facilitate user and core facility staff (CFS) access to biological and medical imaging training through an e-training offer.
- foster interaction and experience sharing between the CFS, and promote the peer networking, to allow and facilitate sharing expertise and communication and interaction between the Nodes personnel, the users and the broad scientific community.

In addition, EuBI will provide information to the community at large, e.g. on initial training in biological and medical imaging at the Master level.

The EuBI virtual platform will link together different tools and integrate a content management system allowing the creation and provision of an online training offer based on both e-learning and e-training. The former will make content available to end-users, such as web-based learning, computer-based learning, virtual classrooms, and digital collaboration, and where users will be able to self-assess their competences. Whereas the latter will ensure, besides proposing e-learning features, a practical and technical training through the use of simulators. In this case, the course will be qualifying and could be used as pre-requisite before accessing the technology.
The following report thus proposes a framework and guidelines for a solid and defined e-learning and e-training concept applied to biological and medical imaging. The definition of this concept entails the following steps:

- Needs analysis and objectives
- Content development strategy
- Tools and services to be implemented on the virtual platform.
- Evaluation and update/upgrade

This report is based on the discussions that took place during conference calls and meetings during the preparatory phase II of the Euro-BioImaging project. Two working groups were involved in these discussions, with a working group dedicated to e-training concept definition within the EuBI project, and another group dedicated to e-training content development within the Global BioImaging project.

2. Need analysis and training strategy

a. NEED ANALYSIS AND OBJECTIVE

In the last years, the training offer in terms of latest development in biological and medical imaging became more and more diversified and specialized to meet the need of high level expertise in core facilities and technical support for user and the broad scientific audience. The biological imaging being subjected to a technical and methodological environment in constant evolution, international collaborations, staff and user mobility, and funding availability, the training offer needs also to adapt quickly, be available at any time and easy to access. Aside from on-site training course offer, e-learning is thus another way to enhance both end-users and core facility staff (CFS) knowledge and to facilitate education and training activities when key expertise is concentrated at relatively few training centres, while the education and training needs are quite widespread. On-line based training also enables the quick implementation of programmes for continued education, including “train the trainers” programmes, and strengthen networking between knowledge centres.

A pan-European survey on biological and medical imaging infrastructures conducted in summer 2011 by Euro-BioImaging PPI WP13 pointed out that the majority of the training courses are run as face-to-face courses combining the theoretical and practical part or as special workshops targeting at one imaging modality. Only a few number of facilities enable open access to their courses by publishing them on-line (see EuBI PPI WP13 D13.6 report). This tendency was confirmed by the survey on training offer in medical and biological imaging conducted by the WP7 team in 2016 and 2017 (see EuBI PPII WP7 D7.4 and D7.5 reports). The lack of available e-learning or e-training resources registered through both surveys points out the need to mobilize the biological imaging community to provide contents and start implementing e-training courses.

For all these reasons, the design and implementation of a virtual platform on the EuBI WAP and the integration of e-training to the EuBI training offer have been included to the roadmap of the Euro BioImaging Project Interim Operation.

The objective of the EuBI virtual platform will be to complete the EuBI service offer in terms of training in biological imaging aimed at infrastructure users and providers while:

- Promoting the peer networking,
- Providing information and resources on initial training in biological and medical imaging,
- Increasing the number of people with solid imaging and management knowledge available to integrate the staff of facilities through initial training,
- Establishing a centralized biological e-training portfolio,
- Training the users before they access the technologies, even remotely,
- Developing new materials and contents for e-training,
- Providing information on the EuBI/GBI shadowing program,
- Offering on the public side an open portal to create awareness about imaging technologies.

b. TERMS AND DEFINITIONS: E-LEARNING VS E-TRAINING

The definition of the terms e-learning and e-training is an important task as both are commonly used indistinctly when having different goals.
In this document, "e-learning" will be used when learning resources are made available online, either as freely browsable content or as part of a more structured learning program.
"E-training" will be used for qualifying path, consisting in e-learning resources associated to assessments. Assessments may come in diverse form, including but not limited to quizzes, short questions and answers series or report of experiments performed on virtual instruments (simulators).

c. TARGET AUDIENCE ANALYSIS AND TRAINING STRATEGY

In order to meet the objective of the platform and define the training strategy, it is important to define the audience of the future contents and tools that will be available on the platform. Two main groups were identified: end-users and core facilities staff (CFS). Students were also proposed as a third group, as the e-learning material might be proposed and valorised as support for universities' teaching programs.

A user typology has been elaborated according to the user background, his motivation to use a training platform and his expertise.

Type of user	Background	Motivation	Expertise
Scientific community	- Students - Researchers in related scientific areas	- To round off their knowledge in imaging technologies - Acquire basic expertise for a specific experiment - To exchange with experimented users	Basic to intermediary
EuBI users	- Postdoctoral students - Researchers	- Access to an imaging technology in a EuBI facility - Improve expertise	Intermediary to high
Imaging companies	- Imaging engineers	- To acquire/maintain knowledge on advanced imaging technologies - To acquire required knowledge on emerging technologies - To access emerging technologies	High
Core Facility Staff	- Imaging engineers - Image analysts	- Knowledge update on specific technologies - To acquire required knowledge on emerging technologies - To access emerging technologies - Last trends in image analysis	High

		- Soft skills and facility management - Access to CFS community	

Based on this typology, 3 EuBI e-learning/training programs have been defined. Each program could have a specific and dedicated approach to meet the user's needs:

- **General principles in microscopy techniques for imaging technology users**
- **Theoretical and practical knowledge (based on virtual tools) in microscopy techniques for imaging technology users (evaluation before access)**. E-training is planned as a mean to evaluate new facility users' knowledge before they access an EuBI facility and help them get familiar with the required key concepts.
- **Advanced theoretical and practical knowledge (based on virtual tools) in emerging microscopy techniques for CFS and staff from imaging companies**. More advanced content should be accessible as part of a life-long training scheme.

d. ADDITIONAL ONLINE TOOLS

Besides the e-learning and e-training programs, different tools aimed at specific audiences could be available on the EuBI website:

- an **e-forum** that will foster interaction and experience sharing between CFS, and help EuBI users from different background to give feedback on their needs, sharing experience and best practices. The EuBI e-forum could provide an opportunity for the community to discuss matters of interest, led by a moderator, through the e-forum discussion list. The e-forum discussion list works like an email list service: participants will have to register their email address, and then they will receive messages and communicate with other participants through an email discussion. Registration will be necessary to participate, but it will be free. All discussions will feed an online board where searches on previous topics will be available.
- a **page providing information on exchange visits across EuBI Nodes**, in particular information about the Global BioImaging Job Shadowing program.
- a **page providing information on initial training in biological and medical imaging in Europe**, e.g. at the Master level for students and future CFS[1].

[1] A first list of Master study programs worldwide with a focus on biological imaging was presented in "Advanced Light Microscopy Core Facilities: Balancing services, science, and career", FERRANDO-MAY ET AL., MICROSCOPY RESEARCH AND TECHNIQUE 79:463–479 (2016).

3. Content development strategy

The course development strategy and the definition of the corresponding processes for its implementation should be based on the following key elements:

- The course content and delivery format selection;
- The overall structuration of the learning and training modules;
- The processes and roles involved in content development;
- The course evaluation procedure.

a. CONTENT DEVELOPMENT: TOPICS AND FORMAT

One of the key elements to be defined when developing content for e-learning courses is the process that will enable the selection of appropriate content and delivery format (e-learning or e-training, see 2.b.) in order to meet the learning objectives and adapt to each user profile.

The content and format selection process will determine how to decide which content, desired topics and subjects, and existing courses and content need to be developed, and in what manner. The decision criteria will take into consideration the target audience, content type, audience needs, possibilities for modularity to meet the needs of other audiences, and criticality of the subject.

The following table proposes guidelines for content and format selection according to the target audience, the topics selected and the desired learning outcome.

For this proposal 4 general topics have been considered:

General topics (Cell Biology & Physiology, Biostatistics, Macromolecules biophysics and interactions, Elements of Mathematics and Physics)

Imaging basics (Microscopy Techniques, Probes, Instrumentation in biological and medical imaging, Laser optics and detectors, Basis in optics)

Imaging specialization (Individual techniques in biological and medical imaging, Digital Image & Image Analysis, Imaging systems metrology)

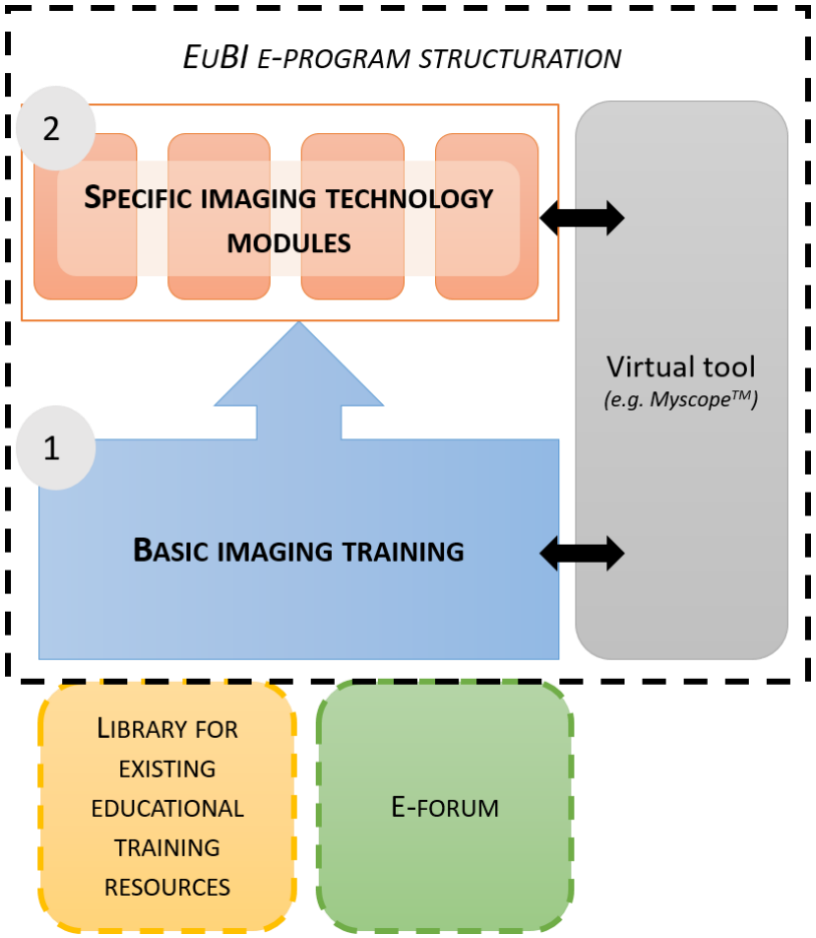
Transversal skills (Language and Communication, Law and entrepreneurship, Sale and Marketing, Project management, Platform management, Quality assessment)

Type of user	General topics	Imaging basics	Imaging specialization	Transversal skills
Scientific community	Available as e-learning	Available as e-learning	Available as e-learning	
EuBI users	Available as e-learning and e-training (pre-requisite for access)	Available as e-learning and e-training (pre-requisite for access)	Available as e-learning and e-training (pre-requisite for access)	
Imaging companies	Available as e-learning and e-training	Available as e-learning and e-training	Available as e-learning and e-training	
Core Facility Staff	Available as e-learning and e-training	Available as e-learning and e-training	Available as e-learning and e-training	Available as e-learning and e-training

It is important to note that in this proposal, e-training might be used for both ensuring a user accessing a EuBI resource center has the required qualification to proficiently use its equipment, or build an individual learning path, for example as part of a life-long training scheme. In the latter case, the creation of a specific certification for successful applicants who validate all the required assessments could be considered.

b. EuBI E-PROGRAM STRUCTURATION

Once the purpose, topics and format of the different e-programs have been identified, the selection and organization of the chosen learning tools will define the overall structuration of the program content. The following proposal for the EuBI e-program structuration is based on the creation of a modular learning system consisting of two blocks, allowing the construction of different learning pathways, as presented in the following diagram:



Block (1) will offer a reminder about imaging basic principles. Users could also be redirected to comprehensive online tutorials for practical training on imaging basic principles[2], including tutorials and materials developed and made available by imaging companies.

Block (2) will gather advanced modules, each of them dedicated to a specific imaging technology. Identified EuBI partners should collaborate in preparing the module content (theoretical presentation, tutorials, etc.). Users could also be redirected to a virtual tool (e.g. MyScope™) for in-depth training.

This modular learning system will be supported by a virtual tool dedicated to e-training that will offer practical learning and knowledge assessment, and allow user's evaluation and technology access validation when required. In order to develop this e-training tool dedicated to practical training on imaging technologies, Euro-BioImaging and Global BioImaging (GBI) partners are collaborating with the Australian GBI partners, the AMMRF, to expand their online microscopy training tool MyScope. MyScope will be then used to provide high quality, online training in microscopy techniques to new users of EuBI facilities. GBI is currently developing additional content on super-resolution microscopy for incorporation into MyScope. Other specialised light microscopy modules will follow.

Also, users of the e-training program will have the possibility to access two additional tools:

- A **library gathering existing educational training resources**. These resources will not necessarily follow an e-learning format but will make available valuable information to users willing to investigate a topic further. This e-library could also be based on links to industry partner or institution existing web pages.
- An **e-forum that will help EuBI users** from different background to give feedback on their needs, foster experience and best practices sharing.

c. CONTENT DEVELOPMENT UNIT

The resources that both the development of appropriate content and its preparation to specific delivery formats will require are substantial and will have to be considered when developing a business plan for the virtual platform implementation project. The following proposal for the creation of a content development unit try thus to be as exhaustive as possible for the purpose of determining the resources needed in an "ideal situation" but could be reworked and adapted according to the available means.

The main mission of the content development unit will be to ensure the consistency of the program content and course delivery format with the desired learning outcomes, and that is why its organization should be planned before the implementation of the virtual platform.
This unit will design the content strategy, assess the content and format requirements, evaluate and approve the content and format to be implemented on the virtual learning platform. The content development unit is divided in two connected committees as presented in the following diagram:

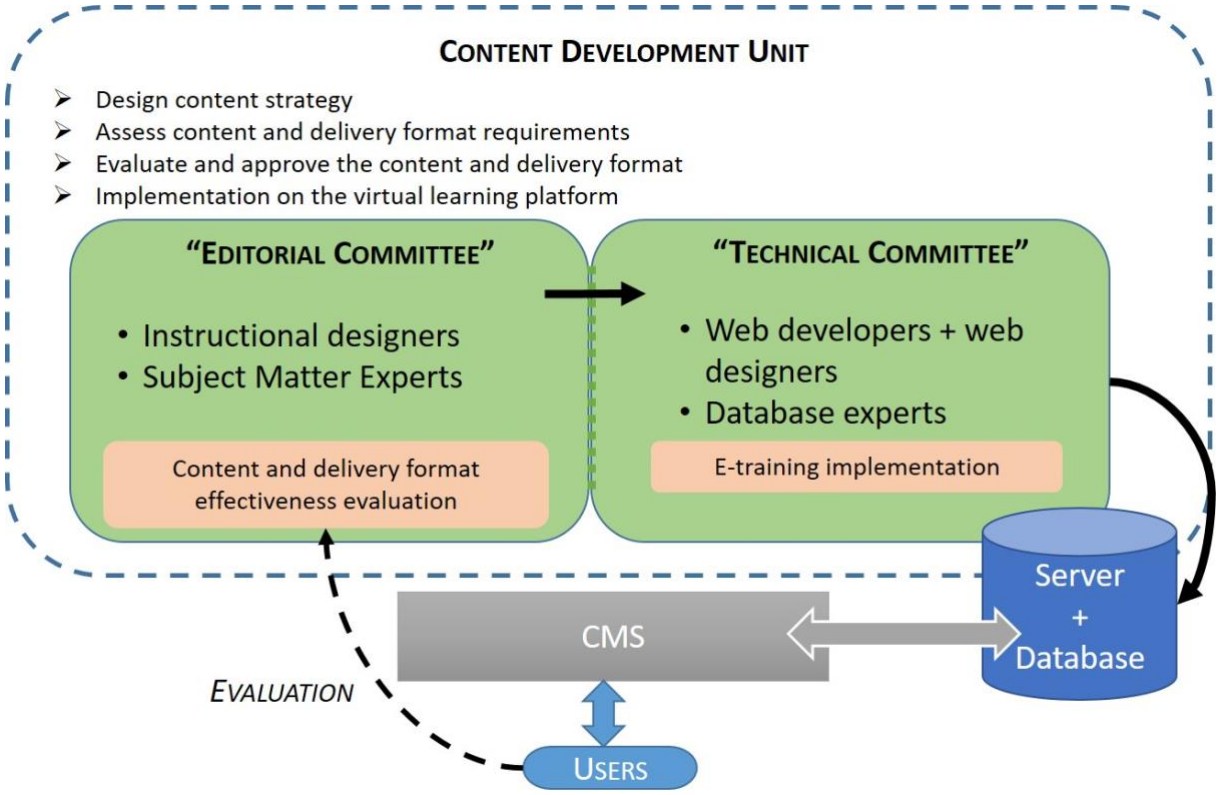
- The **editorial committee**: is composed of instructional designers and subject matter experts. Its task is to design the overall instructional strategy, with the identification of content and delivery format requirements according to the target audience and desired course outcomes. It provides guidelines to courses providers for the e-training course elaboration and can take part to the course elaboration if necessary. Moreover, its members will evaluate the course

[2] Existing interactive tutorials: Myscope (www.ammrf.org.au/myscope), Microscopy Primers (https://micro.magnet.fsu.edu/primer), MicroscopyU de Nikon (https://www.microscopyu.com), Zeiss campus (http://zeiss-campus.magnet.fsu.edu/index.html), iBiology (https://www.ibiology.org/)

content and format effectiveness before its implementation on the virtual learning platform and after its implementation, with the feedback of the testing users.

- *Instructional designers* are responsible for the overall instructional strategy. They work with managers to understand the training goal, collaborate with subject matter experts to define which skills and knowledge need to be covered in the course, choose the appropriate instructional strategy and support the team in defining delivery and evaluation strategies. They also are responsible for designing specific e-learning activities and materials that will be part of the course, including storyboard development.
- *Subject matter experts* contribute the knowledge and information required for a particular course. They collaborate with Instructional designers to design a course and define evaluation strategies.

- The **technical committee**: is composed of the database programmer and web developer. Its task is to ensure the optimal technical implementation of the course content on the virtual learning platform and database preparation. They will provide the technical expertise during the course content development.
  - *Servers/database programmers* may be needed to install and configure databases and to collect learners' data.
  - *Web developers* are responsible for assembling course elements, developing media and interactive components, creating the courseware, adapting the interface of a learning platform (e.g. Moodle) and install the courseware on a Web server. Web designers should be associated to their work in order to prepare the overall graphic design of the platform.



The editorial committee will define instructional design guidelines to ensure that the content creation strategy supports the required training outcomes. These guidelines will also help course providers to convert and/or reuse existing content (e.g. static learning material) into an e-learning course and should ensure the interactivity of the course and an active learning based on learner's engagement. Thus, the use of interactive activities and simulations that illustrate and facilitate the comprehension of the most important concepts involved in a course will be a key requirement.

A first list of requirements has been elaborated and is presented below.

Each course must be composed by:

- 1 Power Point presentation with comments
- References (articles, annexes)
- 1 forum, to be used by participants to interact among them or with the trainer
- A set of sequences; a sequence being the explication of an individual topic, to be covered either in a textual or audio-visual form. Each sequence should not last more than 15 minutes and include a self-assessment (with a commented correction). Various possible sequence format will be proposed. It is important to note that each sequence or group of sequences could be reused in other courses. Thus, each sequence must be built as self-sufficient blocks.

Course template proposal:

- Introduction with basic information and resources references
- Framework of the course with sequences
- One to two new concepts by sequence
- Evaluation: assessment at the end of sequence or group of sequences (questionnaire or practical test)
- Evaluation system should provide references when concept is not assimilated (document with comments)
- Specific chatroom

d. Content Management System (CMS) requirement list

The selection of a CMS will be a key aspect of the future e-program implementation that will be available on the virtual platform.
The CMS is a centralized software application or set of applications that facilitates and streamlines the process of designing, testing, approving, and posting e-learning or e-training content, usually on Web pages. In order to conduct the process of selection of the CMS, the first step will be to identify the different features the CMS should offer in order to host the future EuBI e-programs and associated features, and determine baseline technology requirements and capacity to support the e-learning and e-training strategy.

To this aim, the following requirement list has been prepared:

- **Content shaping**

The CMS should enable to organize the curriculum, learning materials and evaluations into a meaningful and effective learning path.

  - Possibility to create chapters, sequences
  - Timeframe
  - Pre-requisites for the course: ability to define prerequisites and restrict access to courses until the prerequisites are met
  - Reuse of the content

- **Resources availability**
  - File size and file format
  - Maximum number of connection at the same time on specific resources
  - Resource sharing: what type of control on the content?
  - Evaluation
- **Must-have features**

The CMS should enable content and collaborative learning activities. It should offer the possibility to support content libraries as well as custom developed learning activities. Also, the integration of other collaboration technologies such as chat, shared whiteboard, instant messaging should be part of the features offered.

  - Evaluation: Possibility to create quizzes with built-in quiz editor. Upload quiz questions/answers via text file. All quizzes include auto correction, and optional links back to content. Quiz attempts set by course creator. Timed quiz option.
  - Test returning: Supports essay assignments and document uploads
  - Web conference
  - Dedicated forum per courses
  - Chat
  - Library
  - Built-in repository to store auxiliary reference materials, like PDF documents. Option to share materials with trainees. Link towards materials hosted on other web sites.
  - Advanced statistics for course evaluation purpose.

e. E-TRAINING COURSE EVALUATION

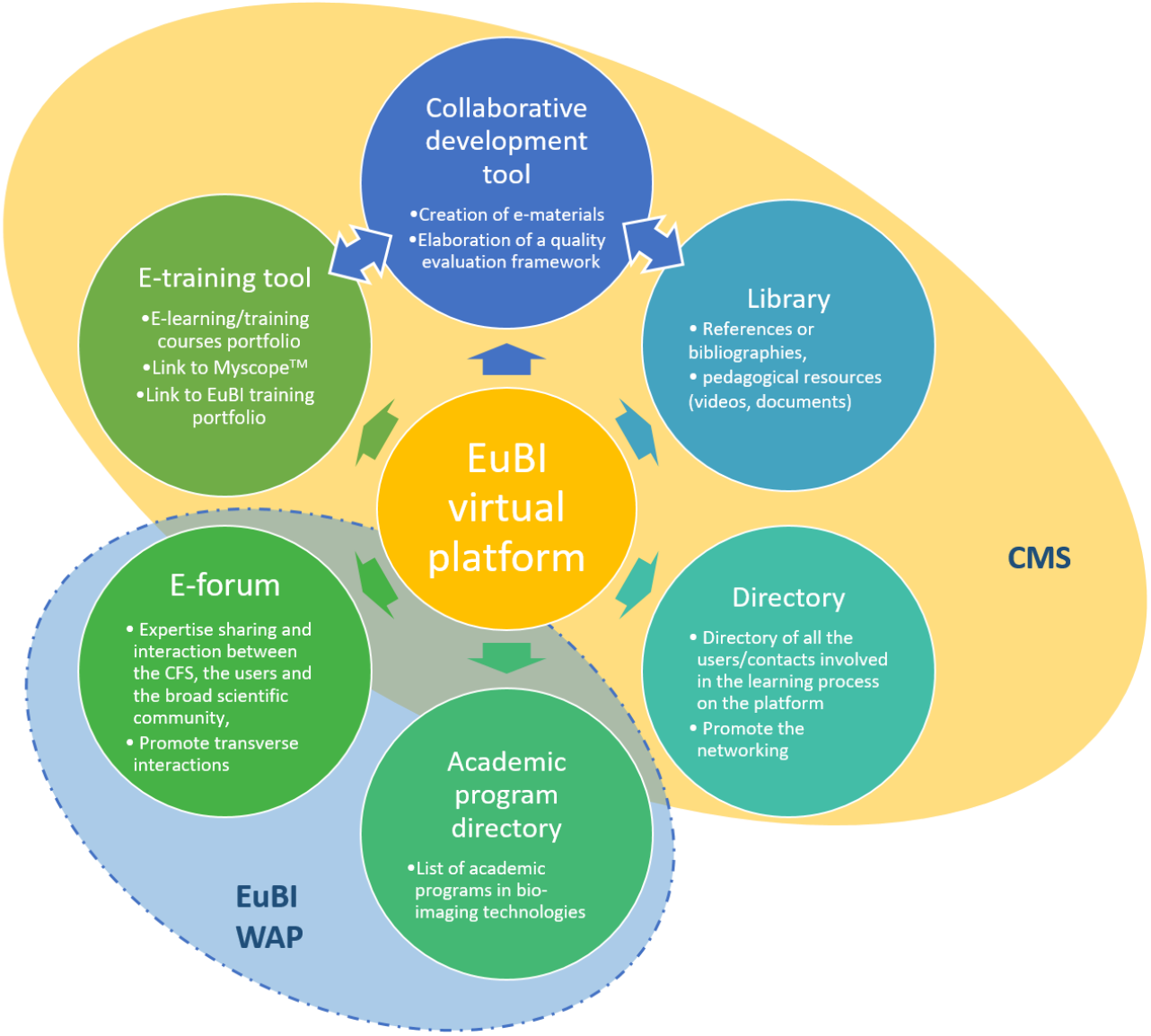
In order to evaluate the efficiency of the content available on the EuBI virtual platform, the content development unit will take benefit of two types of feedback. First, an evaluation form should be set up to collect user's feedback once they have completed an e-program. To enforce feedback collection, filling this survey could be made mandatory to get a certification, when dealing with CFS, or gain access to the targeted equipment, when dealing with EuBI users. A second group of indicators might be setup, to be generated as users progress through the e-learning and/or e-training program:

- Number of registered trainees/number of trainees who fulfilled the complete course: combines the evaluation of the suitability between the description of the course and its content, between the level of the course and the audience, the expected pre-requisites and the actual audience's level of knowledge.
- Number of view per chapter: indicates hot topics that might be developed to a larger extend as new material. In case of high scores being related to same contributor (either as an individual or a node) might help identify users' most preferred way to shape the content. Additionally, in the case of e-training on new technologies, allows evaluating the importance for nodes to get equipped.
- Number of restarts: might be an indicator for a chapter being too lengthy, to be reshaped in more parts.

4. Overall structuration of the future EuBI virtual platform

The tools and services that will be hosted on the EuBI virtual platform will meet the previously identified needs and adapt to the different audiences of the platform, and will be in part based on a content management system (CMS) to accommodate the courses. The features that will be part of the CMS package also define what type of content management system should be used to support the future tools and services proposed by the platform (See 4.d.). The e-forum and the academic program directory could be integrated to the WAP as additional tools, whereas the others features could be included in the CMS features package.

The diagram below presents an overview of the proposed design for the future EuBI platform, with the different tools and features and their distribution between the WAP and the CMS. It is important to note that the WAP could also potentially host the EuBI virtual platform given that it has CMS functionality. This possibility should be evaluated when preparing the implementation of the virtual platform, using a previously established requirement list as reference (See 4.d.).



Moreover, in order to keep track of user's progression as they go through the material, an authentication system should be either used or designed. Two different scenarios are to be taken into account: e-learners and e-trainees. The formers should only benefit from content bookmarking and progression recording. On the Content Development unit side, it would allow collecting usage statistics and material evaluation indicators. For the latter group, in addition, a record of scores/assessment results should be made available, especially for those EuBI users requesting access to the infrastructure. In this case, the authentication methods should be unified as part of the EuBI WAP and account settings together with selected user's information made available to the node providing the access to a technology.

In order to make the credential handling system fit with the virtual platform, new roles will have to be (re)-defined:

- On the user side:
  - e-learner: its extends the concept of regular WAP users. It allows the user to keep track of lectures followed without assessments.
  - e-trainee: its extends the concept of regular WAP users. It allows the user to keep track of lectures followed and of their assessments.
- On the content development unit side:
  - Content creator: provides access to the CMS back-office for creating and editing new lessons. It allows collaborative work but does not allow making new content publicly available.
  - Content reviewer: provides access to the CMS back-office for evaluating new lessons. It should allow accessing newly created therefore hidden content. A commenting system should be available to give feedback to the content creator.
  - Content validator: extends the concept of Content reviewer, adding capability to validate and therefore push validated lessons online.
  - e-training evaluator: provides access to the CMS back-office for evaluating the e-trainees assignments. It should give access to e-trainees' answers to short quizzes, in case an auto-correction is not possible, and allow scores to be attributed.

Also, in terms of integration to the EuBI WAP, several technical points should be addressed to define how the CMS will be linked to the EuBI WAP and more specifically to the user access functionality, or to Myscope™ (to be clarified with GBI dedicated work package).