MACE for Educators
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http://www.mace-project.eu/index.php?option=com_content&task=view&id=15&Itemid=168

MACE supports teachers and learners to increase their knowledge about architecture and construction engineering, it maintains teaching and learning processes and offers a set of various possibilities to utilise the MACE portal and the competence toolset in education. This project enables access to learning units and digital architectural contents irrespective of provenance and language. It provides services for meta-tagging and content navigation as well as search and reuse functions via different possibilities. MACE allows visitors to navigate metadata in order to access content repositories through a toolset for a critical mass of digital content for learning with semantically well-defined metadata and associated formal descriptions that give meaning to metadata. These tools enable the application of quality content based services. MACE contributes an infrastructure that allows interested visitors to participate, even after the project has ended. The competence toolset is part of this infrastructure.

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Description of the Competence Toolset

The MACE application profile (AP) includes a large number of possible classification metadata. Thus it also stores the metadata related to competencies for each learning object (LO) and real world object (RWO) in the classification section of the AP. Each LO or RWO can have any number of competencies associated to it. For each competency of a LO or RWO, the minimum and maximum proficiency scale values, defined according to the European Qualification Framework (EQF), are included.

To collect, catalogue, manage, and maintain the competence metadata a toolset has been created. The core of the toolset is the competence catalogue. It contains competence domains and their related competencies as well as external resources, experts, and a proficiency scale description related to this competencies. On top of this catalogue different applications and widgets can be used for displaying, dynamic updating, and editing
competence metadata as well as for the administration of the competence catalogue. In the following sections the available applications and widgets are described in greater detail.

See also a detailed description in Deliverables JD 9 and JD 11

**Competence Administration Application**

To maintain the competence catalogue the Competence Administration application is used. The application uses the MACE user authentication and management, so the provided MACE credentials can be used to log in. It visualizes the existing competence domains and their related competences (see Figure *Competence Administration*). The logged in user can then add, delete, and edit as well domains as competencies to the competence catalogue.

**Competence Matrix**

On the MACE portal, users can browse the included content repositories and search for learning objects (LO) as well as for real world objects (RWO), including the possibility to browse by competence. This competence driven access enhances the Search & Browse functionality of the MACE portal using the Competence Browser (see Figure *Competence Browser (with Competence Matrix)*). This grid-based browsing application enables the user to explore all competencies by browsing through all available domains. The available LOs and RWOs can be accessed either by selecting a competence,
selecting a specific proficiency scale value for a domain, or even by selecting a specific proficiency scale value for a competence.

Figure: Competence Browser (with Competence Matrix)

**Competence Widget**

Browsing through the content it is possible to view and edit the metadata. Thus a detail page for every LO or RWO is provided (see example). This detail page contains a number of implemented metadata widgets, including a widget to visualise the competence metadata and the aggregations of its values (see Figure **Competence Widget**).
The data is visualized using a bar chart as a basic metaphor showing the aggregated competencies with their EQF-range. The widget enables the user to see all aggregated competencies for the LO or RWO filterable by domain characterised by their EQF-range as well as to add and remove aggregated competencies and edit their EQF-range.

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Teaching Process and Modelling Learning Activities - IMS-LD

One possibility to integrate MACE resources and services in educational activities is to develop IMS Learning Design (IMS-LD) that can be created with an IMS-LD Editor and can be accessed through an IMS-LD runtime player. Therefore, a description of IMS Learning Design (IMS-LD) and Instructional Design (ID) for a better understanding is needed.

What is IMS-LD?

Learning Design is defined by Koper (2005) “as the description of the teaching-learning process that takes place in a unit of learning (eg, a course, a lesson or any other designed learning event). The key principle in learning design is that it represents the learning activities and the support activities that are performed by different persons (learners, teachers) in the context of a unit of learning.” [Koper 2005, p.13] IMS Learning Design (IMS-LD) “aims to represent the learning design of units of learning in a semantic, formal and machine interpretable way.” [Koper 2005, p.13] IMS-LD is a specification that provides a generic and flexible language or a meta-model that can be used to describe different pedagogies. The learning scenarios can be presented to learners online and can be shared between systems. [IMS GLC 2009; Jeffery & Currier 2003; Koper & Tattersall 2005]

According to Koper (2005, p. 14) the IMS-LD specification is developed to meet some specific requirements. These requirements are listed below:

1. Completeness:
The specification must be able to fully describe the teaching-learning process in a unit of learning, including references to the digital and non-digital learning objects and services needed during the process. This includes:
   - Integration of the activities of both learners and staff members.
   - Integration of resources (learning objects and communication/collaboration services) used during learning.
   - Support for both single and multiple user models of learning.
   - Support for mixed mode (blended learning) as well as pure online learning.

2. Pedagogical expressiveness:
The specification must be able to express the pedagogical meaning and functionality of the different data elements within the context of a Learning Design. While it must be sufficiently flexible to describe Learning Designs based on all kinds of pedagogies, it must avoid biasing designs towards any specific pedagogical approach.
3. Personalization:
The specification must be able to describe personalization aspects within a Learning Design, so that the content and activities within a unit of learning can be adapted based on the preferences, portfolio, pre-knowledge, educational needs and situational circumstances of users. In addition, it must allow the designer, when desired, to pass the control over the adaptation process to the learner, a staff member and/or the computer.

4. Compatibility:
The specification must enable learning designs to use and effectively integrate other available standards and specifications where possible, such as the IMS (imsglobal.org) and IEEE LTSC (ltsc.ieee.org) specifications.

The IMS-LD specification consists of several components. It consists of a conceptual model for the description of teaching and learning processes. This model is expressed as an UML model (see Figure The conceptual model of IMS Learning Design). [Koper 2005]

![Figure: The conceptual model of IMS Learning Design (Koper 2005, p.15)]

Jeffery & Currier (2003) point out that in IMS-LD the structure of a learning scenario is separated from the learning materials and services. The materials can be reused in different scenarios and the scenarios can also be reused and new materials added. The authors describe the characteristics of IMS-LD as followed:

“IMS Learning Design relies on a number of elements. These include: roles that people perform (who does what); activities (what they do); and environments, which include where they do them (services) and what they do them with (learning objects). The overall scenario or design is described within the method element, which contains play, act, and role-parts elements,
and is analogous to a theatrical play. A learning design may be based around the achievement of specified learning objectives by learners; it may also define prerequisites. As well as allowing an entire design to be shared or reused, IMS Learning Design allows these elements to be reused in other learning designs.” [Jeffery & Currier 2003, p. 1]

IMS-LD allows teachers to describe and implement learning activities based on different pedagogical modes or approaches to learning, including group work and collaborative learning. It admits them to coordinate multiple learners and multiple roles within a multi-learner model, it support single learner activities as well as the use of learning content with collaborative services. IMS-LD allows teachers to coordinate and to support multiple delivery modes, including mixed-mode learning. [Jeffery & Currier 2003]

IMS-LD helps to create interoperable, flexible, effective, efficient and attractive e-learning courses for teaching and learning architecture and construction engineering with MACE services and resources.

**Instructional Design (ID)**

Instructional Design (ID) is the planning process of general educational principles into course plans and materials. It is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. Instructional design covers the entire process of analysis of learning needs and goals and the development of a delivery system to meet those needs. The process includes development of instructional materials and activities; and evaluating all instruction and learner activities. [Reigeluth 1999]

**Cited Literature**

[Koper 2005]


[IMS GLS 2009]


[Jeffery & Currier 2003]


[Koper & Tattersall 2005]


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**ReCourse Learning Design Editor**

The TENCompetence project has developed a learning design editor - ReCourse. ReCourse (see Figure *ReCourse MACE Template, Screenshot*) is a system that targets educational practitioners and instructional designers with little experience with the technical specification of IMS-LD [IMSLD 2003]. ReCourse supports modelling and arranging of learning activities graphically and to store them in IMS-LD. This enables teachers and trainers to specify the process metadata for using MACE objects and services based on instructional design. ReCourse allows to integrate external resources (objects, links, etc.) and services (search & browse etc.) in the planning of the educational process. It is a key feature of ReCourse to model the learning process in detail, and to store the resulting units of learning (UoL) in the standardised format of IMS-LD. Furthermore, ReCourse allows templating of UoL, which can be reused in different settings.

ReCourse enables us to create learning scenarios with several possibilities to demonstrate the usage of MACE content based on instructional design for educational activities. In ReCourse we can create course modules for different topics with various phases and various learning activities. These course modules can be embedded and integrated in a learning environment, which is specially designed to meet the requirements of the learning process for a chosen topic. Each activity of the learning design consists of the following parts:

- related roles, such as teachers, students, or working groups;
- learning objects from external resources;
- learning activities or learning tasks, such as presentation, case study, practical exercise, sketch/drawing, homework revision session, recurrent mistake, simulation/role play, tutorial, forum/faqs, discussion, chat, vote;
- support activities, such as tutoring or feedback rounds.
ReCourse supports teachers and instructional designers modelling several learning paths based on the modelled learning activities. This allows different arrangements for several instructional methods, such as presentation, demonstration/modelling, problem solving, case based instruction, discourse based learning, cooperative group learning, field trip or autonomous learning.

The open modelling concept of ReCourse allows embedding MACE objects and services in the instructional design. This can be used to offer teachers in the domain an easy access to the project’s resources through educational templates, which define tasks, related resources and supporting activities. The actual UoLs can be prepared by filling and re-arranging these templates with the information for the planned course.

OUNL developed learning scenarios and example UoLs with ReCourse based on the scenario analysis of WP2 and a literature study. The UoLs serve as a proof-of-concept for integrating the MACE services and contents into IMS-LD. This enables the consortium to define templates that can be used by educators in different educational settings and be instanced with the according contents. OUNL provides an sample template for UoLs that use the MACE services and contents in order to support teachers for using the MACE resources according to their needs.

ReCourse - Learning Design Editor
ReCourse - Learning Design Runtime Tools
ReCourse User Guide Menu
**Cited Literature**

[IMSLD 2003]

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**Learning Design Template and Examples for MACE**

**MACE LD-Template**

As described above, teachers can create their own courses with ReCourse. For this they have to install the ‘TENCompenence Learning Design Editor’, which is available at http://www.tencompetence.org/ldauthor/.

In ReCourse the created Learning Design will be automatically coded in XML which defines a Unit of Learning (UoL). “The term ‘Unit of Learning’ (UOL) is used to describe an IMS Content Package that contains a learning-design element as its organisation.” [Koper & Tattersall 2005, p. x] The UoL can be played on the CopperCore Learning Design Runtime Engine after packaging it into a zip-file and uploading it to the CopperCore system for making a ‘run’. A run is generated by the runtime engine. Afterwards, learners can join the UoL through anURL.

![Figure: ReCourse MACE Template, Screenshot](image)

The MACE LD-Template (see Figure ReCourse MACE Template, Screenshot) supports teachers who want to create an online course with ReCourse. This template is based on the description of teaching in WP2 and uses MACE services and resources. It helps to provide a range of
pedagogical structures which can be enriched with resources and learners.


**Description of the MACE sample LDs/UoLs**

OUNL has built two learning designs to demonstrate the possibilities of the ReCourse learning design editor:

a) ‘MACE – UoL: Selforganised Learning About Modern Architecture’ and
b) ‘MACE - Deconstructivism (Villa dall'Ava S01)’.

![MACE - UoL: Selforganised Learning About Modern Architecture](image)

In both UoLs a user can login as a ‘Learner’ or as a ‘Teacher’. The units of learning are available at http://coppercore.tencompetence.org:8080/sled3/.

The following steps are needed for accessing the UoLs.

Login for learners
Username: mace_learner_1 [mace_learner_2; mace_learner_3]
Password: [none]

Login for teachers
Username: mace_teacher
Password: [none]
**MACE - UoL: Self-organised Learning About Modern Architecture**

This UoL (see Figure MACE - UoL: Selforganised Learning About Modern Architecture, Screenshot) is an example for the possibilities of preparing teaching and learning architecture and construction engineering using ReCourse. It provides a proof-of-concept for integrating MACE services and contents in IMS-LD (see Figure Integration of MACE content, Screenshot).

The topic of this LD is ‘Self-organised Learning about Modern Architecture’. In this course learners can learn the principles of modern architecture. They get an overview of the general topic, and in addition to this, they can focus on a chosen topic, which they are especially interested in. Thereby the students activate their existing knowledge of modern architecture and obtain knowledge of history and theories of modern architecture and the related arts, technologies and human sciences. They learn to search for relevant content and information. The students work on a topic and focus on it. They summarise the results of their work for a presentation. Finally, the students will have to discuss their results with their peers.

Through this learning offer, the students can regulate their own learning process – they learn how to identify their learning goals and learning needs. The LD has three phases: a preparation phase, a working phase, and a completion phase. To the learners only the learning activities are visible. The teacher – logged in as teacher’s role – can see only the support activities for the course. Both roles have only access to their activities, while the phases are inherent to the structure of the course. The teachers get an overview to all support activities, which they have to provide to the learners during throughout the learning process.
Each learning activity has a description that informs the learners about the objectives of the task. The associated environment provides all resources that the learners need to complete the activity’s task. These resources can be for example ‘Tool Objects’, ‘Knowledge Objects’ or widgets such as ‘Chat’ or ‘Discussion forum’. Step by step the learners will advance through the course. This can be by studying the provided content, by exploring new topics, by searching appropriate resources, by working out a project description, by preparing a presentation, by presenting their work, and by discussing the results with their peers.

**MACE - Deconstructivism (Villa dall’Ava S01)**

This LD (see Figure **MACE - Deconstructivism (Villa dall’Ava S01), Screenshot**) is based on the scenario analysis that is provided in Deliverable 2.2, and is related to ‘Scenario 01 – Personal Learning in Architectural Design’. In this scenario a meaningful fragment of a student’s personal learning process in an architectural design course is captured. The student has to acquire the thorough understanding of a building’s architectural values by pointing out its formal features and relating them to other relevant buildings, to the architect’s history and to its historical period. In this case, learning means to realize the network of relations that structure acquire information. A simple search with online search engines would overload the student with unnecessary information, which hinders the learning process. The Scenario shows how MACE uses thematic search to solve this problem and produces much more focused and effective results.
**Cited Literature**

[Koper & Tattersall 2005]


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**OAI-PMH Target**

OUNL created a harvesting interface through which the MACE portal can retrieve metadata about the learning designs. The MACE harvester can use this target to copy the Learning Design (LD) metadata into the MACE metadata cache. KUL has build a search engine executes searches on this cache and by doing so enables transparently searching he content available in different repositories (including the learning designs.)

The MACE LDs (Units of Learning (UoL) and the MACE LD-Template) can be found through searching the MACE portal. See the results below.

**MACE LD-Template**

Self-organised Learning About Modern Architecture
Deconstructivism (Villa dall'Ava)

For more information about the OAI-PMH Target go to [http://www.openarchives.org/OAI/openarchivesprotocol.html](http://www.openarchives.org/OAI/openarchivesprotocol.html).

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**Recommended Literature for IMS-LD and Instructional Design**


York: Springer Verlag.


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