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Report on the Standardized Description of Instructional Models

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[1] OJ L 79, 24.3.2005, p. 1.

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1 Introduction

One of the primary objectives of ICOPER is to make digital content accessible within an interoperable, standards-based infrastructure. An essential ingredient to achieve this objective is an empirically grounded understanding of how teaching practitioners in higher-education institutions approach the tasks of designing, describing, sharing and reusing instructional models and units of learning, in their crucial components: content (WP4), learning objectives (WP2), teaching methods (WP5) and assessment processes (WP6).

As a major step towards this understanding, this report investigates the state of the art in representing generic as well as contextualised instructional models. The report introduces a structured description template for generic teaching methods, by drawing on findings from previous projects and initiatives, and by involving teaching practitioners and educational researchers in (a) the evaluation of the template and (b) the collecting of teaching methods. A set of instructional modelling use cases is included to identify and describe key interactions of teachers and learning designers with instructional modelling artefacts in the Open ICOPER Content Space (OICS; see deliverable D1.1). An initial proposal for a metadata application profile for teaching methods and units of learning supporting the use cases within OICS is presented.

This report is structured as follows:

- Section 2 introduces the key instructional modelling concepts used in ICOPER and in this report.
- Section 3 presents an overview of relevant instructional modelling initiatives, a set of criteria for good teaching practice, and a presentation of ten of the most relevant classification initiatives related to teaching and learning.
- Section 4 outlines the problem statement and goals of WP3.
- Section 5 details the process of constructing a structured description template for teaching methods.
- Section 6 presents results of the template evaluation as well as the final template.
- Section 7 specifies interactions of stakeholders with instructional modelling artefacts within the ICOPER technical infrastructure in the form of use cases. Section 8 summarizes the report and outlines open issues to be addressed in further work.

2 Key Concepts for Instructional Modelling in ICOPER

This section introduces the key concepts and terms used in this report and in ICOPER for issues of relevance to WP3, dealing with instructional modelling. WP3 decided to start the elaboration of instructional modelling key concepts based on two central concepts: '**teaching method**' as a generic representation of learning and teaching activities, and '**unit of learning**' as a concrete, contextualized unit of education or training. Relevant related concepts were identified and included into the WP3 key concepts map in an iterative process. Coordination with other ICOPER work packages and refinement of concept definitions and relations resulted in the key concepts map depicted in Figure 1.

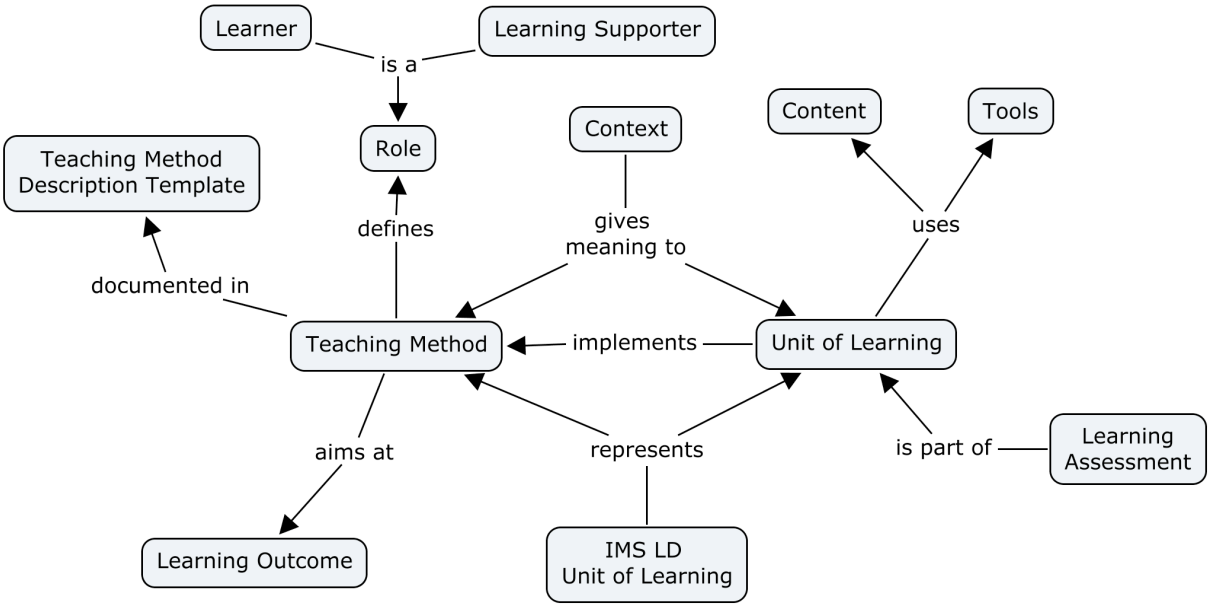

Figure 1: Map of key concepts for Instructional Modelling.

The key concepts are defined as follows:

- **Teaching Method.** *A teaching method is a learning outcome oriented set of activities to be performed by learners and learning supporters.* Examples for teaching methods are the lecture method, problem-based learning, and the think-pair-share method. Teaching methods are described using a teaching method description template. Typically, teaching methods are generic descriptions of activities, independent of specific content or an application context. Teaching methods are realized in units of learning within a specific context and with associated content. A teaching method can be expressed as an IMS LD Unit of Learning. Examples of teaching methods worked out by the COSMOS project can be viewed online[2].

- **Unit of Learning.** *A unit of learning refers to a contextualized, complete, self-contained unit of education or training that consists of a teaching method and associated content* (adapted from Olivier & Tattersall, 2005, p. 25). A unit of learning can be a combination of multiple teaching methods; it can be expressed as an IMS LD Unit of Learning. To view a teaching method (here: guided research model), which was adjusted to the specific context of teaching dark matter in astronomy in order to create a unit of learning, see the COSMOS portal[3]. The document referred to in footnote 2 also includes an example of the *guided research model* turned into a unit of learning (adjusted for the context of teaching circular motion).

- **Teaching Method Description Template.** *The teaching method description template provides a text-based template for structured and meaningful description of a teaching method*. It includes a number of teaching method inherent elements (e.g. sequence of activities, roles, etc.) and teaching method context elements (e.g. subject domain, target group, etc.) to enable understanding and reuse of the teaching method by

[2] The COSMOS project has developed six teaching methods, which are called educational scenarios in their terminology:
http://www.cosmosportal.eu/cosmos/files/help/COSMOS_Learning_Activities_Templates.pdf

[3] http://www.cosmosportal.eu/cosmos/en/node/3608 (Free registration needed for full view)

practitioners. The construction of the template is reported in Section 5, its evaluation in Section 6, and the final version of the template is presented in Section 6.3.1.

- **IMS LD Unit of Learning.** *An IMS LD Unit of Learning is an IMS LD-compliant, XML-based definition of a unit of learning or teaching method*.

- **Learning Outcomes.** Learning outcomes means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence (European Commission, 2008, p. 11). This concept is the main link to ICOPER WP2 (see D2.1).

- **Learners.** *Learner is a role that performs learning activities in a teaching method or unit of learning to achieve intended learning outcomes*. Learner is a generic role, which can be specified by various concrete roles that are defined by the teaching method (e.g. in Jigsaw learners assume the role of experts, presenters, and so forth).

- **Learning Supporter.** *Learning supporter is a role that supports the learner role during the activities of a teaching method or unit of learning*. Learning supporter is a generic role, which can be specified by various concrete roles that are defined by the teaching method. Typical learning support roles are teacher, instructor, facilitator, external expert, moderator, etc.

- **Content.** *Content refers to any learning object or material used in a unit of learning*. This can be a website, lecture slides, a textbook, etc.

- **Context.** *The context of a teaching method/unit of learning is the set of elements that are external to and give meaning to a teaching method/unit of learning*. For instance, subject domain or target groups are elements of the teaching method context.

- **Learning Assessment.** This is a core concept from WP6 (assessment and evaluation), which defines learning assessment as the process of testing the learning outcomes (knowledge, skills and/or competences) attained by a certain learner and providing the corresponding information reporting about the student achievements and/or potential indications for improving them; it comprises identifying, collecting and preparing data to evaluate the achievement of program outcomes and program educational objectives.[4] With regard to WP3, learning assessment is used in units of learning.

3 Problem and Goal Statements for Instructional Modelling in ICOPER

3.1 Problem Statement

The goal of the ICOPER project is to identify best practices for using educational technology standards in European higher education institutions. More specifically relating to WP3, the goal is to identify where and how standards for instructional modelling are used at European higher education institutions. Questions that relate to this goal are:

[4] This definition was taken from the D6.1 draft dated 17 September 2009.

- Where are best practices for instructional modelling performed at European higher education institutions?
- What best practices exist for the use of standards in instructional modelling?
- What best practice do we recommend for using standards for instructional modelling in higher education institutions?

Currently, only one standard for instructional modelling exists, i.e. the IMS Learning Design (IMS LD) specification (Koper, Olivier, & Anderson, 2003). From our current understanding, this standard is not being used in large scale implementations at European higher education institutions. One question in this regard may be why there is only one standard dealing with instructional modelling, when the field of Educational Technology usually spots several standards for similar purposes. Reasons for this could be that instructional modelling has only been researched for a short time. There is not a long tradition for capturing pedagogical practice and specific teaching methods. Instructional modelling could thus be called an emerging domain. This is opposite to, for instance, the Learning Object Metadata (LOM) standard (IEEE, 2002), which has predecessors in analog media storage having a long history in library science.

What adds to the problem of an emerging domain is that a career in higher education is still driven by research results that a scientist achieves rather than the teaching performance s/he exhibits. Instructors at a higher education institution are experts in their respective field but have most likely not been trained in setting up learning and teaching environments. Rather, they often teach how they were taught. It is uncommon that higher education instructors apply theoretical models from instructional systems design in their teaching practice (Beetham, 2004). In addition, teachers and instructors are not used to communicate among each other about their teaching, and they don't document their teaching practices in a systematic manner (Beetham, 2004). Therefore, little is known about the process of how instructors (in higher education settings) go about designing their instruction.

Former initiatives at the Open University of the Netherlands, namely, the development of the Educational Modelling Language (EML) (Hummel, Manderveld, Tattersall, & Koper, 2004) and its successor IMS LD, are laudable initiatives to overcome the stated problem of the lack of teaching documentation. However, these initiatives have found little acceptance in the teaching practitioner community (Downes, 2009; Griffiths & Blat, 2005). The lack of a common central repository that stores IMS LD units of learning may be one of the reasons why adoption is hindered (Gilbert Paquette, as cited in Downes, 2009).

Last but not least, only a few evaluations of IMS LD have been performed. However, none of them was performed by/with instructors. For instance, Dolonen (2006) reports about an empirical study of IMS LD. The study found that IMS LD provided important concepts for expressing pedagogical models but exhibited problems in regard to providing dynamic group behaviour and advanced routing. Van Es and Koper (2006) evaluated IMS LD for its ability to express different types of courses. They found that IMS LD faced limitations when certain characteristics of the teaching and learning situation were unknown during design time, such as the number of repeating a certain activity ("repeat for as many groups as present"). Finally Paquette (as cited in Downes, 2009) mentions the specification's weakness with regard to collaborative activities and its expressiveness considering competences.

So there are two problem areas to be investigated: the area of the teaching process (how instructors go about teaching), and the area that IMS LD spans. The specific problems that ICOPER WP3 will address regarding the teaching process are

- how generic teaching method descriptions support passing instructional modelling knowledge among teachers,
- how teachers contextualize generic teaching methods, as well as
- how teaching methods could be classified so that instructors can choose from are questions that this problem relates toadequate teaching methods to expand their teaching repertoire.

The problem that IMS LD pertains to is

- how instructors are able to transfer their own (representations of) teaching concepts into the structure/language that IMS LD offers
- what benefits arise for higher education instructors when doing so
- whether IMS LD is flexible enough to express instructional models of today's higher education instructors, and
- what benefits IMS LD holds for higher education institutions.

3.2 Goal Statement – Towards a Framework for Good Teaching Practice

Higher education institutions have the goal to foster good teaching practice as can be seen from the multiple, world-wide initiatives that dedicate themselves to this topic (cp. also the initiatives described in Section 4.1 of this report). The Bologna process kicked off several reforms (e.g. the three-tier educational system, ECTS credits) aiming at the promotion of students' mobility by increasing transparency and comparability of higher education programmes within Europe (Confederation of EU Rectors' Conference & Associaton of European Universities, n.d.). European universities thus enter a competition for attracting students from all over Europe and abroad by offering high quality study programmes borne by good teaching practice. This goal requires that instructors know what good teaching is and what steps to take to offer good teaching themselves.

One prerequisite for encouraging good teaching practice is the communication of (good) teaching practice, implying the documentation and exchange of such practices. Although such communication is most likely to take place between instructors at the same institution, instructors may also expand their communication circles using online exchange platforms.

Our goal is thus to develop an **ICOPER Framework for Good Teaching Practice**, inspired by the idea that "reuse" of good teaching practices is possible. The framework is meant to support teaching practitioners and learning designers in identifying, developing, documenting, and sharing good teaching practice. As depicted in Figure 2, the framework consists of four core components:

- *Teaching Method Description Template*: enables uniform documentation and communication of generic teaching methods that embody good teaching practice. The creation and evaluation of the description template are central parts of this report (see Sections 5 and 6, respectively). The creation of the description template was based on several previous initiatives with similar objectives as listed in Section 4.1.
- *Units of Learning*: these are provided as contextualized example implementations of teaching methods. Units of learning support teaching practitioners and learning designers in contextualizing generic teaching methods, and in reusing concrete existing examples of good teaching practice. Some of these units of learning will be provided as IMS LD compliant content packages.

- *Criteria for Good Teaching Practice*: In order to enable identification and deployment of good teaching practice by educational stakeholders, the framework provides a set of nine criteria that were collated from existing initiatives of developing criteria for good teaching. The criteria are presented in Section 4.2.
- *Educational Taxonomy*: The taxonomy will be developed as an easy-to-use tool for the classification of teaching methods and units of learning. The development of the taxonomy is still in progress, but the underlying existing educational classification initiatives have already been identified and evaluated (see Section 4.3).

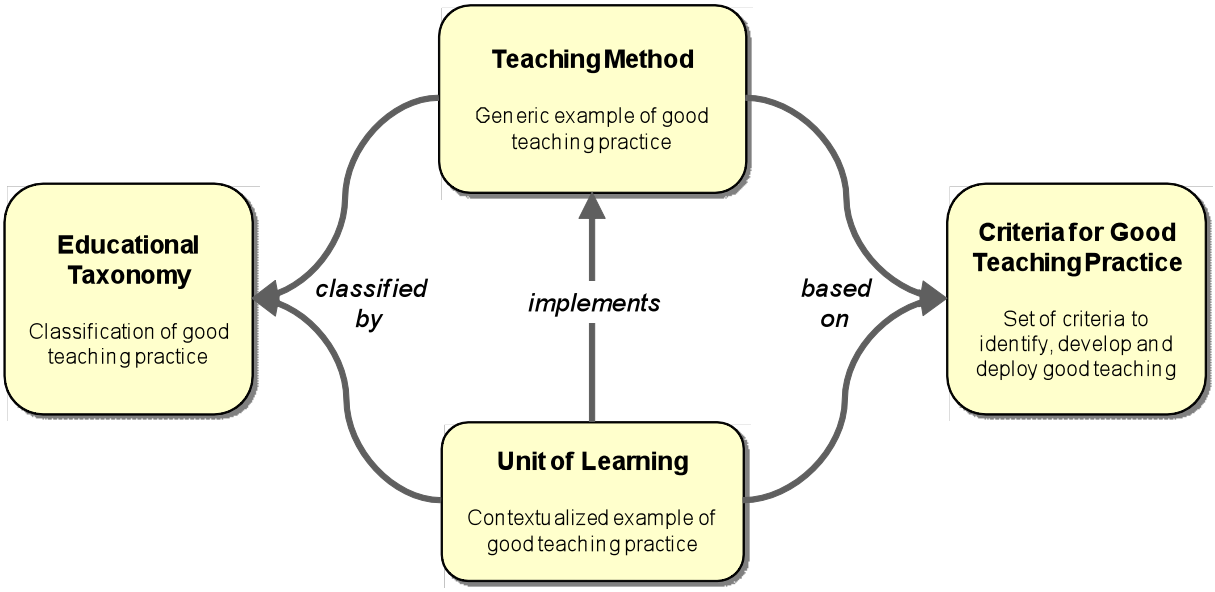

Figure 2: ICOPER Framework for Good Teaching Practice.

The components of the framework are woven together within the ICOPER technical infrastructure[5] using the LOM standard (IEEE, 2002). The work up to this point (and which is described in this report) has focussed on the description of teaching methods, on the description of units of learning as well as on the identification of criteria for good teaching practice. Future work will focus on the connection of these concepts with IMS LD as well as the Educational Taxonomy.

4 Overview of Relevant Initiatives and Specifications

This section provides an overview of initiatives that relate to the goals of WP3 and the ICOPER Framework for Good Teaching Practice. These initiatives are included to build the context into which the ICOPER WP3 initiatives fit outside the realm of ICOPER, and to help the reader understand how the WP3 work positions itself among similar initiatives. They include:

- initiatives that have proposed description schemas for instructional models (section 4.1)
- initiatives that have provided guidelines for good teaching practice, especially in higher education (section 4.2), and

[5] The first draft of the LOM application profile, which enables describing teaching methods, units of learning and their relationships, is presented in Annex D.

- initiatives that focused on classifying concepts related to learning and teaching (section 4.3).

4.1 Instructional Modelling Initiatives

There are several existing initiatives that deal with instructional modelling issues of relevance to WP3. Particularly as input to the construction of a teaching method description template, the objective was to get a comprehensive overview of previous approaches to describing teaching methods for sharing and reuse. The following existing collections were analysed:

- *101 e-Learning Seminarmethoden* (Häfele & Maier-Häfele, 2004): Presents 101 methods for preparing, running and evaluating e-learning seminars. These include methods for personal introduction (e.g. for breaking the ice) and advanced methods for creating and facilitating various e-learning course formats. The structured description of each method includes elements such as name, summary, goals, tools, when to use, group size, duration, sequence, examples, remarks, experiences and references.

- *AUTC Learning Designs Project* (Learning Designs Project, 2003): This project aimed at producing reusable, generic learning designs to assist teaching practitioners in creating technology-supported learning experiences. Besides providing generic guides and contextualized exemplars of learning designs in various contexts, the researchers in this project also pioneered in the provision of a structured description template along with visual representations of learning designs (Oliver, Harper, Hedberg, Wills, & Agostinho, 2002). Essentially, a learning design visually and textually captures the interplay of activities, resources and learning supports. The description format of learning designs includes general metadata like title, author, discipline, study program, size/scope of learning design, as well as detailed information on the learning setting and delivery context.

- *BMUKK Virtual School Austria Scenario Description* (Kranebitter, 2008): The Austrian Federal Ministry for Education, Arts and Culture is involved in several European Union co-funded projects, where a strong focus is put on the development of scenarios representing good technology-supported teaching practice. The initiative's goal is to support teaching practitioners in planning and designing subject-specific courses as well as to assist them in choosing appropriate teaching methods. A template was distilled from available good practice scenarios that facilitates the documentation of teaching approaches and makes this – sometimes implicit knowledge – accessible for teacher colleagues. The template consists of three categories: The first category contains bibliographic elements, e.g. author, contact information, name of the organization etc. The second category focuses on the description of the scenario's pedagogical characteristics, e.g. tasks, intended learning outcomes, prerequisite knowledge, and the third category finally offers descriptive elements for the required resources, e.g. educational content, infrastructure, and media.

- *Template for describing a case study in e-learning practice* (Beetham & Sharp, 2007, p. 242): This template has been developed by JISC (Joint Information Systems Committee; see http://www.jisc.ac.uk) in close cooperation with several UK Higher Education Academy subject centers to collate case studies at a national level. The collection of systematically described case studies represents a knowledge base that teaching practitioners can access when designing for learning. The template consists

of a set of elements that are considered to be important and useful by representatives of the subject centers. The elements are classified into six categories, Curriculum and intended learning outcomes, Activity, People involved, Environment for learning, Outcomes for learners and Reflections, each of which contains three to six elements together with explanatory remarks and examples. The template's users are asked to tailor the template according to their specific requirements and needs.

- *COSMOS Project* (http://www.cosmos-project.eu): The main objective of the European Commission co-funded project "COSMOS" is to make existing educational content in astronomy and physics accessible and reusable for end users. In the project, a template for the development of technology-enhanced educational scenarios was devised and several units of learning were described based on the template. It comprises a structured set of descriptive elements, e.g. title, educational problem, scenario objectives, learner needs and characteristics, educational approach, learning activities (type, technique, interaction, etc.), participating roles, tools, services and resources, as well as a graphical representation. An official cooperation between ICOPER and COSMOS was established to pool know-how and experience gained within both projects. The COSMOS units of learning will be evaluated with respect to inclusion in the ICOPER Framework for Good Teaching Practice as contextualized example implementations of teaching methods.

- *Catalogue of didactic models*: Flechsig provides a German-speaking catalogue (1983) and handbook (1996) of didactic models that are described using a uniform template consisting of description elements related to didactic principles, phases, elements and their properties (learner, context, tasks, etc.), evaluation, application area, and variants.

- *JISC Mod4L Project* (Falconer, Beetham, Oliver, Lockyer, & Littlejohn, 2007): In this project the researchers collected information requirements of teachers during browsing, choosing, developing and instantiating a learning design. In group work, teaching practitioners recorded their information requirements during these phases. The requirements were subsequently grouped into eight themes, with each theme including a set of information elements: instantiation (e.g. design, timing, sequence etc.), adaptability (granularity, flexibility etc.), pedagogy (assessment, activities, purpose, etc.), discipline (e.g. content, learning outcomes etc.), environment (e.g. resources, tools, context, delivery mode etc.), audience (group size, level etc.), quality (student feedback, peer review etc.), and operational factors (e.g. time/effort, barriers, etc.). Each information element was rated in terms of importance for each of the four phases mentioned above.

- *JISC Pedagogical Vocabularies Project* (Currier, Campbell, & Beetham, 2005): This project investigated, among other things, the role of vocabularies for sharing and reusing learning designs. The researchers suggest that the following elements must be separately specified for each learning design (p. 79): type of learning activity, desired learning outcomes, systems or services required in the activity, other learning environment aspects, and roles of participants.

- *Organic.Edunet* (http://www.organic-edunet.eu/organic/index.html): The European Commission co-funded project "Organic.Edunet" aims to facilitate access, usage and exploitation of digital educational content related to Organic Agriculture and Agroecology. In this project, a template was developed for the description of teaching scenarios and the usage of educational content. The template's elements are

subdivided into three categories comprising general information (e.g. title, target group, language, duration, subject domain), contact information (e.g. author), prerequisites and detailed information (e.g. required hardware, infrastructure), scenario-specific information (e.g. tasks, learning outcomes, activities).

- *Design pattern templates*: Voigt and Swatman (2006) performed a comprehensive review of pedagogical design pattern initiatives and projects with particular emphasis on the description format and structure of patterns. While pattern initiatives in education generally rely on pioneer work by Alexander and colleagues (1977), there are substantial differences in the way these initiatives actually represent and describe their patterns. Voigt and Swatman identified dozens of design pattern description elements, which were grouped into five shared top level elements: Name; Context (problem context, conditions, educational paradigm, domain specifics etc.); Problem (general description, forces at work, example, scope etc.); Solution (introduction, detailed description, principles, visual aids, consequences etc.); and Evaluation (empirical background, method, references etc.)

- *Person-Centered e-Learning (PCeL) patterns*: this initiative (Derntl, 2006) has collected numerous educational design patterns capturing person-centred e-learning settings (see http://elearn.pri.univie.ac.at/patterns). As opposed to most other educational pattern initiatives, which describe patterns in the classic Alexandrian prose-style format (Alexander et al., 1977), the patterns in the PCeL repository are described using a structured, uniform set of explicit description elements, e.g. name, intent, motivation, scenario, parameters, examples, and references, thus relying on a more structured pattern description template as proposed, for instance, by the "Gang of Four" (Gamma, Helm, Johnson, & Vlissides, 1995).

- *Phoebe Pedagogic Planner* (http://phoebe-app.conted.ox.ac.uk/): Phoebe is a website where registered people can upload and share their learning designs. It aims to provide guidance in planning teaching and learning activities. The basic template for Phoebe pedagogic designs is structured into sections, with each section comprising a number of description elements, e.g. contextual information (author, course information, timetabling), curriculum aspects (learning outcomes, resources, teaching approach), assessment, students (number, learning styles etc.), learning activities (type, description, etc.), contingency plan (flexibility, alternatives), alternative activities, and reflections (personal impressions, quality etc.)

- *ViB Project*: the German Virtualization in Education project (Schröder, 2002) was concerned with formal specifications of innovative didactic conceptions using computer science methods like the Unified Modeling Language (Rumbaugh, Jacobson, & Booch, 1999). For describing didactic conceptions, the researcher refers to the pattern template that was originally proposed by the Pedagogical Patterns Project (http://www.pedagogicalpatterns.org), consisting of the following sections: name, date, author, thumbnail, problem/issue, audience/context, forces, solution, discussion, resources, contraindications, related patterns, examples, references and acknowledgements.

- *Wippermann* (2008) developed a catalogue of criteria for documenting e-teaching methods. Criteria include information about target group, action form, social form, process form, roles, context, content, time, etc.

- The *IMS Learning Design (IMS LD)* specification (Koper et al., 2003) prescribes a standardized modelling language for representing learning designs as a description of teaching and learning processes able to be executed by a software system that coordinates all involved people, resources and services. The specification hence supports the interoperability of learning designs aiming at enhancing sharing and re-usability of pedagogical settings (Heyer, Oberhuemer, Zander, & Prenner, 2007).

Compared to the WP3 goals, we found that the initiatives presented above pursued different goals with their description schemas. All but one of them focussed solely on the description of instructional models without taking into account aspects relevant to the reuse of teaching methods, which is the process of an instructor going through a repository to find adequate teaching methods and units of learning. This process entails that the instructor first identifies relevant teaching methods/units of learning when browsing or searching a repository. When a selection was made, the instructor then needs to adapt the teaching method or unit of learning to his or her own teaching context. Different information is needed for the different stages of this process. The only project that focussed on this particular process was JISC's Mod4L Project (Falconer et al., 2007). However, this initiative looked at the process without drawing conclusions on a precise description format for teaching methods. Therefore, we took the results of this project as a starting point for our efforts. In our development, we geared the structure of the template towards the needed information during repository searches and adaptation of units of learning. We set up the first version of the template based on Mod4L's outcomes joined with the results of the above initiatives (this work is described in section 5). We then evaluated the so created template to arrive at a final proposal for a description template to be used in repository storage (this work is described in section 6).

4.2 Criteria for Good Teaching Practice

To enable identification and development of teaching methods and units of learning that embody good teaching practice, one of the components of the ICOPER Framework for Good Teaching Practice is the provision of a set of criteria for good teaching practice. For this effort, we did not create a set of criteria from our own experience. Instead, we used criteria that were presented by other organizations using the following frequently cited sources:

- Best Teaching Practice at Penn State University (Butt & Reutzel, 2005)
- Fink's Five Principles of Good Course Design (Fink, 1999)
- Guidelines for Good Teaching Practice at the University of New South Wales (UNSW, 2006)
- High Quality Learning Designs by the AUTC Project, University of Wollongong based on Boud & Prosser (2001)
- Seven Principles of Good Teaching Practice by Chickering & Gamson (1987)
- Six Key Principles of Effective Teaching in Higher Education by Ramsden (Ramsden, 1992b)
- Seven Step Program for e-Learning Improvement (Quinn, 2005)

These principles were chosen because they aimed at higher education or e-learning. We understand that this sample is not representative. However, our interest in the principles for good teaching was whether we could identify common themes across different sets of principles. Other initiatives that were not part of this selection could then later be mapped onto the criteria presented below, or could be used to create new criteria.

From the sources named above, we first isolated all principles and hereafter merged them to commonly themed groups. Nine groups of criteria turned out using this method. Of the 58

isolated principles, only six could not be mapped to any of the nine groups. For a complete list of how principles from each source were mapped to the groups see Annex A.

The nine criteria of good teaching practice are as follows:

1. Prepare (for) learning
- Prepare and communicate the agenda for learning including goals, expectations, and grading
- Create interest in students for the topic to be learned

2. Incorporate learners' backgrounds, experiences and expectations
- Set up the learning so that it incorporates students' prior experiences and knowledge
- Tailor the learning to student's expectations

3. Connect learning to a (larger) context
- Draw connections between the learning experience and contexts, in which the learning is or will be relevant

4. Challenge learners
- Involve learners in learning activities that are challenging to them and foster their higher order thinking skills

5. Employ multiple teaching methods
- Include different activities and methods during learning to foster different skills and cater to different learning styles

6. Actively engage learners in learning
- Involve learners in learning by including activities that place students in active roles and lets them practice

7. Facilitate interaction and collaboration
- Arrange interactions between learners and faculty and among learners themselves
- Provide opportunities for learners to work collaboratively

8. Give feedback and include appropriate assessment
- Provide feedback to learners that is frequent and timely
- Provide assessment opportunities that are targeted towards the learning outcomes

9. Collect feedback from learners
- Collect feedback from learners to judge learners' knowledge levels and to find ways to improve your teaching

4.3 Classification Initiatives

As input to the development of an easy-to-use educational taxonomy within the ICOPER Framework for Good Teaching Practice, we reviewed 37 classifications that relate to learning and teaching. Investigations into teaching method taxonomies are necessary because repository storage requires that teaching methods can be easily found and retrieved. Ten of them (the most prominent and relevant ones) are introduced here and described in Table 1. Please see Neumann (2009) for a complete list of reviewed classifications.

The starting point for the literature review was a thorough search of the Joint Information Systems Committee (JISC) reports. The literature review included nearly all references cited in the classification relevant JISC reports (e.g. Conole, Littlejohn, Falconer, & Jeffery, 2005; Currier et al., 2005; Mayes & de Freitas, 2005). We then searched for additional English literature in the JSTOR, Education Resources Information Center, and google scholar databases. To offer a perspective outside English literature, we included German references as there is a long tradition of systematizing instructional knowledge in this culture. The representativeness of the chosen sample references is hard to estimate because the characteristics of the overall population are unknown. We assumed for this study that the sample references are signature examples of the field because all references are cited frequently within the community. We have included the number of citations of the 10 presented sources as part of Table 1. Citation frequencies were taken from the google scholar database on September 25, 2009.

Table 1: Classifications for learning and teaching.

Classification & Citation Frequency	Description
Anderson & Krathwohl Educational Objectives Taxonomy (Anderson & Krathwohl, 2001) *Cited 1200 times*	Anderson & Krathwohl revised the original framework by Bloom et al. to refocus attention on Bloom's Handbook and to incorporate new knowledge and thought into the framework since its introduction in 1956 (p. XXIf). The taxonomy consists of a two-dimensional matrix, where one dimension comprises six levels of cognitive processes, and the other dimension consists of four types of knowledge.
Brown et al.'s lecturing styles (Brown, Bakhtar, & Youngman, 1984) *Cited 14 times, and 44 times for the successor by Saroyan and Snell*	258 lecturers at the Universities of Nottingham and Loughborough filled out questionnaires on their lecturing habits. Answers were statistically evaluated for validity and reliability. As a result, Brown et al. identified five clusters of lecturers, each having a distinctive pattern of lecturing style (oral lecturers, exemplary lecturers, information providers, amorphous lecturers, self doubters). The five types of lecturing styles were associated significantly with subject areas: Oral lecturers were more common in the humanities and social sciences, exemplaries were more common in biomedical science, information providers and amorphous lecturers were more common in science and engineering. Self doubters appeared to be distributed across subject areas.
Conole's taxonomy of learning activities (Conole, 2007) *Cited 19 times, respectively, 197 times for the foundation laid by Laurillard's taxonomy*	The taxonomy attempts to consider all aspects and factors involved in developing a learning activity, from the pedagogical context in which the activity occurs through to the nature and types of tasks undertaken by the learner. The components of a learning activity are: context in which the activity occurs, the pedagogy adopted, and the tasks undertaken. Similar to Laurillard's taxonomy, tasks are classified in six types: assimilative, information handling, adaptive, communicative, productive, and experiential.

Classification & Citation Frequency	Description
Felder & Silverman's learning and teaching styles (Felder & Silverman, 1988) *Cited 1257 times*	The learning style model classifies students according to where they fit on a number of scales pertaining to the ways they receive and process information. Parallely, a teaching-style model is introduced which classifies instructional methods according to how well they address the proposed learning style components. The four dimensions of learning and teaching styles are sensing/intuitive, visual/verbal, active/reflective, and sequential/global. The corresponding teaching styles are concrete/abstract, visual/verbal, active/passive, sequential/global. The learning styles are driven by the hypothesis that if engineering instructors include elements for each of the poles for each dimension, they achieve an optimal learning environment for most students. Scales of the model are seen as independent of each other; they are orthogonal, except for the sequential/global and sensing/intuitive dimensions, which show a moderate degree of association (pp. 104 & 108).
Flechsig's twenty didactic models (Flechsig, 1983; Flechsig, 1996) *Cited 94 times*	The author describes a process of reducing complexity from teaching practice and translating these practical observations into models of teaching (didactic models). The target audience for the catalogue of didactic models are innovation-willing practitioners. The models are meant to be used for planning and construction of teaching situations, and as an aid for determining if everyone talks of the same model and its constituent action steps.
Leclerq & Poumay's 8 Learning Events (Leclercq & Poumay, 2005) *Cited 5 times*	The 8 Learning Events feature sets up matching learner and tutor activities. The 8 events are imitation / modelling, reception / transmission, exercising / guidance, exploration / documenting, experimentation / reactivity, creation / confortation, self-reflexion / co-reflexion, debate / animation. Leclerq & Poumay chose the number 8 for their number of events on the basis of the limits of human cognitive processing according to Miller (1956), arguing that all learning events can be called into working memory at the same time. The authors state that the 8LEM is "not deemed to be true but useful". Ranking of events within the list does not relate to the events' importance or value. The events do not exclude one another.
Merrill' thirteen classes of instructional transactions (Merrill, 1999) *Cited 197 times*	According to Merrill, all instruction involves acquisition of the knowledge and skills promoted by the fundamental transactions. The thirteen classes of instructional transactions are identify, execute, interpret, judge, classify, generalize, decide, transfer, propagate, analogize, substitute, design, and discover. The transactions for IDENTIFY, EXECUTE, and INTERPRET are building blocks that account for the instructional strategies found in most of the existing instruction in training. Merrill assumes that different knowledge structures require different types of instructional transactions, and that different transactions promote

Classification & Citation Frequency	Description
	the acquisition of different types of learner capability.
Ramsden's theories of teaching (Ramsden, 1992a) *Cited 3391 times*	Ramsden distinguishes three theories of teaching: 1) Teaching as telling or transmission, 2) Teaching as organising student activity, and 3) Teaching as making learning possible. The three presented theories of teaching are based on what lecturers have said about the problems and possibilities of improving learning and teaching. Ramsden states that the three theories have a "progressive, or hierarchical, structure" (p. 116). He regards the theories as logical constructs rather than descriptions of individual courses.
Reeves' Pedagogical Dimensions (Reeves, 1997) *Cited 157 times*	Reeves developed fourteen pedagogical dimensions that are used to compare computer-based education and learning systems. Using the fourteen dimensions, a cultural profile of that system can be created. Examples for dimensions are instructional sequencing, goal orientation, value of errors, and role of the instructor. Reeves wants to perform additional research to identify relationships between ratings received on the fourteen dimensions and the actual instructional effectiveness and impact of the educational programs.
Reigeluth & Moore's Framework for Comparing Instructional Strategies (Reigeluth & Moore, 1999) *Cited 59 times*	Reigeluth & Moore provide five facets along which to compare instructional strategies. The five facets are types of learning, control of learning, focus of learning, grouping for learning, interactions for learning, and support for learning.

We provide summaries of the review results here; for a detailed description of the results, please refer to Neumann and Koper (in press). The first analysis step, which employed discriminant analysis, produced three groups of classifications:

- *narrow focus classifications:* these classifications placed emphasis on singled-out components of teaching methods such as learning objectives or lecturing styles,
- *holistic focus classifications:* these classifications placed emphasis on the gestalt of teaching methods, or placed emphasis on an overarching learning theory view on teaching methods, and
- *versatile focus classifications*: these classifications placed no particular emphasis on any aspect of teaching methods. Rather, they tried to cover a large set of descriptors for the same.

When the classifications were compared to taxonomy validation criteria (Lambe, 2007), only a small number of the reviewed classifications fulfilled more than one of the eight accounted for criteria. The most criteria any classification fulfilled was three. The review further showed that eventual users of the classifications were never involved during the development phase.

The literature review concluded that a classification for teaching methods is still needed. Current classifications do not provide sufficient quality or purpose-related extensiveness. Suggestions for new developments of teaching method classifications should incorporate the classification users' experiences and usage procedures to ensure that the classification reflects their perspectives, their ways of organizing, and their language. As a result of this review, one of our goals is to develop a classification of teaching methods that is oriented towards instructors' needs when planning instruction. Instructors will be involved in the development This classification will be part of the ICOPER Framework of Good Teaching Practice.

5 Creating a Description Template for Teaching Methods

5.1 Motivation

The knowledge and experience of teaching practitioners is mostly implicit, and the concepts they draw on when deciding on teaching strategies are based on prior examples (Beetham, 2004). Teaching practitioners are generally little accustomed to systematically documenting their teaching methods for exchange and reuse. The release of the IMS Learning Design specification was one milestone in *enabling* the exchange of descriptions of teaching methods. The downside to this specification is, however, that it is not easy to understand and work with (Griffiths & Blat, 2005). Because of these difficulties and the slow uptake of IMS LD, several initiatives have begun to foster distribution and reuse of teaching methods, resulting in a great number of competing description formats (cp. Section 4.1). None of these formats, however, has yet reached wide acceptance (compare, e.g. Falconer & Littlejohn, 2007).

In the context of WP3, the previous efforts with respect to the documentation of teaching methods and the use of the standardized modelling language IMS LD will be brought together. This is achieved by first developing a fit for purpose teaching method description template, and second, by examining the potential of the IMS LD specification's concepts and language to model the teaching methods described that way. This section describes development efforts and evaluation results regarding the teaching method description

template. The use of a template-based approach to describing teaching methods as opposed to free-form or narrative approaches is grounded in the conviction that a structured template provides a scaffold for efficient authoring, communication, searching, and comparison of descriptions, particularly when descriptions are provided by a multitude of practitioners and authors. This is aligned with the current trend towards more consistent and common ways of documenting teaching methods (Agostinho, 2009).

Specifically, the teaching method description template will serve two main purposes regarding the goals of WP3 and the ICOPER Framework for Good Teaching Practice. First, it serves as a starting point and assists instructors in transferring generically described teaching methods into their own teaching context. When an instructor encounters a new teaching method, s/he needs both the generically captured teaching method and an inspiring unit of learning based on that teaching method (ideally from their subject of teaching), to build their own unit of learning (Sue Bennett, personal communication, October 27, 2008). We thus need to offer both, the teaching method along with a unit of learning. Second, the description template for teaching methods is an essential component when investigating the IMS LD specification's potential for representing teaching practice. The elements contained in the description template represent the state of the art in documenting teaching methods. This state of the art template can then be compared to the description elements (activities, act, role-part) that IMS LD offers.

5.2 Methodology

In a first step, the frequency of occurrence of descriptive elements in the description formats of the collections listed in Section 4.1 was analyzed. IMS LD was excluded from this study, as the goal is to compare the eventual description template to the IMS LD elements. As a result, more than forty distinct elements were identified. The process of "discovering" elements in each collection was executed as follows:

1. Extract the elements that are used to describe the teaching methods in the collection;
2. Match each element to either a previously identified element of another collection or define a new element that is distinct from existing ones.

For illustration, consider the following example: In collection A there is an element "group size". It is the first occurrence of an element relating to the (optimal) number of students for applying the teaching method. We add a new, distinct element to the set of description elements. In collection B we encounter the element "number of learners". This element matches the "group size" element identified previously, so we record that for collection B the element "number of learners" matches the existing "group size" element identified in collection A. Following this procedure, all new elements and matches were recorded in matrix form with the identified distinct elements listed in the first column, total number of appearance of the elements within the selected sources in the second column, and matching elements of collections in the following columns. A part of the resulting matrix that displays the top ten elements (only four collections included for illustration) is given in Figure 3.

		Case Study	GONG	COSMOS	Mod4L
Sequence/activities	14	Activity/tasks	Activities/process/theory	Learning Activities	Timings
Delivery context	13	Physical/social setting	Delivery context, broader context		Location
Educational approach	12	Technique	Activities/process/theory	Educational approach/technique	Approach/strategy
Learner profile	12	Level of study/Learner characteristics	Learner profile	Characteristics and needs of learners	Level
Name/title	9		Title	Title	Title
Group size	9	Number of learners	Delivery size		Group size
Author	8		Details of designer		Teacher
Resources	8	Resources	Resources/materials	Resources	Content resources
Goals/aims	7	Aims/rationale		Scenario objectives	Rationale, Aims and objectives
Tools	7	Tools		Tools/services	

Figure 3. Teaching method description elements accumulation matrix (partial).

While the frequency of occurrence of an element in existing collections is certainly useful information, it cannot reasonably be used as the exclusive criterion for creating a description template. Therefore, a method for the final selection of elements was established. The foundation for this process was the JISC funded Mod4L project (Falconer et al., 2007), where information needs of instructors during browsing, selecting, developing, and implementing teaching methods were investigated. The Mod4L researchers collected those information needs during practitioner workshops. They identified over 60 information elements and collected practitioner "requests" for these elements during the four phases mentioned above. Since the outcomes of this project were obtained through practitioner involvement, we decided to rely, as a first step, on a selection of those elements that were requested most frequently. However, we discovered that after this step some elements, which prominently occurred in the collections we analyzed, were still missing. So we complemented these elements of the Mod4L workshop with frequently occurring elements from our own aggregation matrix (cf. Figure 3).

Additionally, we decided to split the description template into two sections in reaction to the four phases proposed by the Mod4L project: (1) a "teaser" section offering essential information for browsing and selecting, and (2) a detailed description section including information oriented more towards application and reuse. This split becomes necessary when teaching methods will be presented in a search environment. The resulting template is presented in the following section.

5.3 Results: First Version of the Teaching Method Description Template

The **teaser** section, which may be shown as introductory information when searching for teaching methods in a repository, includes the following elements[6]:

- **Name**: Title of the teaching method. (*Example: Brainstorming*)
- **Author and copyright**: Name and optional contact information of the person who filled out this teaching method description, as well as copyright information. (*Example: Michael Derntl, University of Vienna, michael.derntl@univie.ac.at; Copyright: Creative Commons*)
- **Summary/Thumbnail**: Overview of teaching and learning activities in this teaching method; quick information about key points of the teaching method. (*Example: Ten-*

[6] Each element in this list is described by its title printed in **bold face**, a description in normal font, and in parentheses an example in *italics*. This format was used in the Word document version of the teaching method description template that was sent out to practitioners to collect teaching methods (see Section 6, and in particular Section 6.1.1).

Plus-Two method is used to break long presentations. Instructor presents for ten minutes, learners then reflect two minutes. Repeat.)

- **Rationale for teaching method**: Why and when is the method being used? (*Example: To foster active participation of and communication between students.*)
- **Subject/Discipline**: In what (topical) area of study can this teaching method be used? (*Example: Civil engineering, geotechnics and hydraulic engineering*)
- **Learning outcomes**: The intended goals for learning. (*Example: Learners are able to calculate forces on dams.*)
- **Group size**: The approximate number of participants suitable for this teaching method. (*Example: The method is ideal for 15-20 participants, max. 30 participants*)
- **Duration**: The amount of time it takes to complete the teaching method when it is being used/implemented *(e.g.: 2 hours, if it is a large group 3 hours)*
- **Learner Characteristics**: Description of the "target group" of this teaching method, i.e. the learners' age, level within the curriculum, prerequisite knowledge, special attributes, or qualities. (*Example: 15-35 years of age, introductory stage in college, high knowledge of technology*)
- **Type of Setting**: The setting in which the teaching method is intended to be implemented. (*Example: Distance learning, blended learning, face-to-face*)

The **detailed information** section includes the following descriptive elements:

- **Graphical Representation**: A depiction of the teaching method. (*Example: flow chart, activity diagram, swim lanes*). Note: The template that instructors filled out during the evaluation also included an example screenshot of an activity diagram, and a hyperlink to the Graphical Learning Modeller (Neumann & Oberhuemer, 2008), an open source tool for IMS LD compliant modeling of teaching methods and units of learning.
- **Sequence of Activities**: Detailed description of all activities (including assessment) performed by the participants as part of the teaching method as well as the activities' temporal sequence. (*Example: 1. [Presenter] Present the concepts to be learned for ten minutes; 2. [Learner] Share and reflect together with another learner what has been presented in the last ten minutes; 3. [Presenter] Repeat steps 1 and 2 as necessary.*)
- **Roles**: Name and short description of roles that the participants take within the teaching method. (*Example: tutor, moderator, discussion participant, expert*)
- **Type of Assessment**: The intended method for assessing learners' progress and learning outcomes. (*Example: portfolio, multiple-choice test, oral exam*)
- **Resources**: Detailed description of the requirements for implementing the teaching method including room equipment, IT infrastructure, software, virtual learning environment, personnel resources, learning materials, and other supports. (*Example: flip chart, projector, forum or chat, at least 5 tutors, facilitator's toolkit, study guide*)
- **Alternatives**: Description of possible variations of the teaching method. (*Example: To ensure that all participants contribute ideas during brainstorming, you may use note cards for collecting ideas instead of contributing ideas by shouting. Each participant writes their ideas on note cards and then shares them publicly.*)

- **Teacher Reflection**: Description of experiences that teachers have had when implementing the teaching method, benefits and opportunities, risks and threats. (*Example: Method works well when learners are active contributors. Preparatory effort of this method is high.*)
- **Student feedback**: Description of feedback that students have given when they learned with the teaching method. (*Example: Students liked the active participation during this method. Some students were afraid of the ill-structured nature of the method, because a lot of the responsibility is shifted to the students' side. This may cause discomfort.*)
- **Peer Review**: Evaluation of the quality of the teaching method by a qualified peer or a colleague instructor. (*Example: The teaching method fulfils 8 of the 9 good practice criteria for teaching as identified by WP3 of the ICOPER project.*)
- **Comments**: Any comments from people who have read or applied the teaching method.
- **References**: Any references to the original source of the teaching method, background literature, or to resources used within the method. (*Example: Reigeluth, C.M. (1999). Elaboration Theory. In Reigeluth: Instructional Models - The New Paradigm. Mahwah, NJ: Lawrence Erlbaum.*)

Note that this was the initial version of the template that was subjected to evaluation (see Section 6) and used for collecting teaching methods. It was then revised according to the obtained evaluation results (see the revised final version in Section 6.3.1).

An example of a filled out template for the teaching method "Image Sharing" is included in Annex B.

6 Evaluation of the Teaching Method Description Template

The evaluation of the teaching method description template proceeded in two consecutive phases. In phase I (see Section 6.1), evaluators were asked to describe one of their teaching methods using the description template, and to provide judgment of the template on various criteria of good descriptions. In phase II (see Section 6.2), evaluators were asked to read teaching methods written by other evaluators and to judge their confidence of implementing the method, and to make suggestions on modifying the elements included in the template. Both evaluation phases and the obtained results as well as a discussion of the results are presented in this section.

6.1 Phase I – Evaluating the Template from the Author's Perspective

6.1.1 Methodology

Evaluators were asked to partake in the evaluation if they have had teaching experience in higher education. Some evaluators additionally had research experience regarding higher education teaching. Evaluators performed two tasks during the first phase of the evaluation. They first described one teaching method from their own teaching context using the template. After the evaluators had described their teaching method using the template, they rated the appropriateness of the template. For judging, criteria for good descriptions were used, which were derived, among others, from Lambe (2007). The criteria were formulated as statements,

and the participants had to rate for each statement on a five-point Likert scale, whether they strongly agree (5), agree (4), neither agree nor disagree (3), disagree (2), or strongly disagree (1). The participants ($n = 22$) were also asked to provide additional comments to any of the criteria. The following criteria/statements were used:

- *Completeness*: the template covers all relevant aspects of a teaching method; there are no descriptive elements missing.
- *Clarity*: it was clear what the descriptive elements in the template meant.
- *Allocation*: it was easy to allocate information regarding the teaching method within the descriptive elements of the template.
- *Understandability*: the descriptive elements in the template support the reader's understanding of the teaching method.
- *Distinctiveness*: the descriptive elements of the template are distinctive, i.e. they do not overlap.
- *Appropriateness*: a structured template (compared to, for instance, a narrative) is an appropriate instrument for representing teaching methods to support readers in browsing, selecting and implementing teaching methods.
- *Reusability*: the template supports reusability of described teaching methods for myself as well as for others.
- *Added value*: filling out the template provides added value for my own work/teaching (e.g., it fosters personal reflection, supports documentation, fosters exchange with colleagues, etc.)
- *Durability*: the template seems durable, i.e. it seems unlikely that it needs to be changed in the (near) future.

6.1.2 Results

We collected 34 highly diverse teaching method descriptions. These descriptions included well-known teaching methods such as role play, brainstorming and reflection, creative workshops, e-portfolios, peer-to-peer teaching, and project-based learning; in addition, they included a wealth of teaching methods that are not so commonly known, e.g., resource-based analysis, online reaction sheets, image sharing, or constellation (for the complete list of teaching methods that were collected please refer to Annex C of this document). More than half of the teaching methods had a typical duration of less than a day. Blended and online teaching methods predominantly had longer durations, i.e., days to weeks. Most of the teaching methods had online elements (i.e., are either blended or purely online), and about one third had a setting that was primarily face-to-face. Only a handful of teaching methods have been described using all or nearly all elements of the template. Also, the amount of information provided varied greatly, with some evaluators providing extensive descriptions, while others provided rather brief, bullet-list descriptions.

The ratings that the evaluators gave in their second task are summarized in the histogram in Figure 4. Results are explained in terms of the average of each rating (M), standard deviation of ratings (SD), and correlation coefficient (r), which were calculated according to confidence intervals (p).

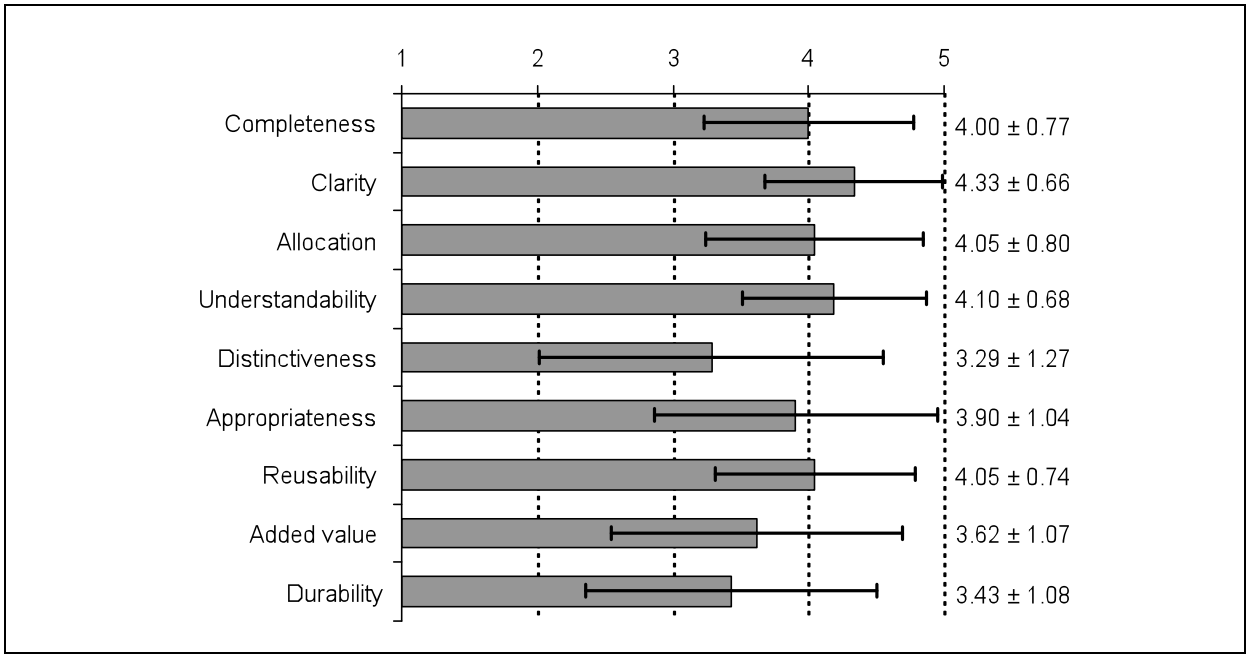

Figure 4: Evaluation of the teaching method description template with respect to nine different criteria (Likert scale: 1 = strongly disagree … 5 = strongly agree; $n = 22$).

Five of the above criteria were rated with an average score of at least 4 points; these are completeness, clarity, allocation, understandability and reusability. These criteria also happen to have the lowest standard deviation values of all nine criteria, indicating considerable agreement among participants.

The template was broadly considered as *complete* (M = 4.05, SD = .79). However, some participants provided additional comments as to what aspects are still missing. In particular, participants, who rated the completeness of the template with a value of 3 or lower, missed elements where activities can be described in more detail, where one could link the teaching method to theory, or desired information on how it is embedded within other teaching methods. Another remark was that it was hard to capture the essence of a teaching method in purely written form. It is evident that some of these comments refer to missing elements that are in fact included in the template. For instance, it was not prohibited to include pictures in the text, and there was a dedicated element for providing a graphical representation of the teaching method.

Clarity received the highest average rating (M = 4.32, SD = .66), indicating that the descriptive elements of the template have meaningful titles and purpose. Correlation analysis using Pearson's correlation showed that clarity has significant positive correlation with the judgment of the template's distinctiveness ($r = .75$, $p < .01$), and the template's appropriateness ($r = .55$, $p < .01$), respectively. This seems plausible, since clear meaning of elements also helps distinguishing the elements and it also supports the positive judgment of the appropriateness of a structured description template.

Every person has his/her own mental representation of a teaching method. The *allocation* of those "mental chunks" to the elements of the template seemed to be easy for most participants (M = 4.05, SD = .79). Note that this criterion has a positive correlation with understandability ($r = .44$, $p < .05$), appropriateness ($r = .48$, $p < .05$) and added value ($r = .58$, $p < .01$), indicating that people who find it easy to allocate information to descriptive elements in the template also perceive added value (e.g. supporting reflection and documentation) in filling

out the template. It also seems reasonable to assume that people who find it easy to allocate information to elements of a structured description tend to expect that this description will be easy to understand by readers.

The most controversial criterion was the *distinctiveness* of the template's elements, having the lowest average value (M = 3.32) and the highest deviation (SD = 1.25). However, low distinctiveness is not necessarily a negative property of a set of description elements. For example, the elements describing roles, sequence of activities, and graphical representation were deliberately designed to be non-distinctive in the sense that they view the same concepts from different perspectives. As one comment reads, "there is some overlap but I think that may be inevitable."

The *appropriateness* of using a structured description template for describing teaching methods was rated fairly high (M = 3.91, SD = 1.02). Participants who gave high ratings for clarity, allocation, distinctiveness and added value, also tended to give a high rating to the appropriateness ($p < .05$, respectively).

Reusability of teaching method descriptions using the template was rated high (M = 4.00, SD = .76). However, as one participant commented this judgment is "based on expected benefit, not on real experience." Another participant stated that it might help her reuse the teaching method but may not help others. The actual reusability of teaching method descriptions needs to be tested in practice.

The *added value* perceived during the writing of the teaching method received a moderately high average rating with considerable deviations (M = 3.55, SD = 1.10). The comments were controversial. For instance, one participant mentioned that "working on activity descriptions is [hard but] this is the core of reflecting on learning situations." Others mentioned that "there's no particular incentive" in filling out the template and that "reflecting and sharing might be quite different processes [needing] quite different types of descriptions and templates." Rating data showed that judgments of added value correlate with easy allocation of information to template elements ($r = .58$, $p < .01$) and with perceiving structured templates as an appropriate description format for teaching methods ($r = .43$, $p < .05$). These two correlations suggest that authors who have little trouble allocating their information to descriptive elements perceive structured templates as an appropriate means of sharing teaching practice, and consequently also expect readers to perceive added value from their descriptions. From the author perspective this reasoning is perfectly understandable; however, we will point out during the discussion of phase II results that authors' and readers' views can be quite different (cf. Section 6.3).

Finally, the *durability* of the template was rated moderately high (M = 3.41, SD = 1.05), with some hoping for changes ("I hope the order of presentation changes"), and some simply stating that this would be "difficult to predict."

A tabular overview of the correlations of the ratings of the different criteria is presented in Table 2.

Table 2: Correlation coefficients of evaluators' ratings of criteria (n = 22).

	Complete	Clear	Allocation	Understandable	Distinctive	Appropriate	Reusable	Added Value	Durable
Complete	1								
Clear	–.31	1							
Allocation	–.24	.35	1						
Understandable	.26	.30	**.44***	1					
Distinctive	–.31	**.75****	.42	.27	1				
Appropriate	–.29	**.55****	**.48***	.17	**.59****	1			
Reusable	–.16	.20	.24	.10	.30	.31	1		
Added Value	–.31	.21	**.58****	.25	.32	**.43***	.40	1	
Durable	.26	.15	.09	.09	.04	.21	.42	.13	1

* … $p < .05$, ** … $p < .01$

6.2 Phase II – Evaluating the Template from the User's Perspective

6.2.1 Methodology

The purpose of phase II was to evaluate the effectiveness of the template in regard to transferring a teaching method described by someone else into one's own teaching context. Evaluators received for this phase an evaluation form that consisted of three parts:

1. A teaching method description that was written by another evaluator
2. A continuous rating scale ranging from "very confident" to "not at all confident" for judging how high evaluators estimate their ability to transfer the described teaching method into their own teaching contexts. In this part evaluators were also able to provide comments on positive and negative aspects about the described teaching method.
3. A form that asked evaluators to choose up to three description elements (like duration or group size) they would remove from the template, and to specify up to three description elements they would add to the template. This part also included a text box to justify each of the suggestions for adding or removing elements in the template.

Of the 34 teaching methods collected in phase I, three were selected to be included in the phase II evaluation. These three teaching methods were selected because they were described using extensive and cohesive information, and because they represented a range of teaching methods differing especially in terms of duration, type of setting, and the number of resources needed during implementation. The selection of the three diverse teaching methods was grounded on the assumption that the final evaluation of the description template (third part of the phase II evaluation form) would turn out less biased towards a particular type of teaching method, and be thus more representative, if the teaching methods differed inherently. The three chosen teaching methods for phase II were:

- **Role Play**: During a lecture class, learners team up to take on roles of student, teacher, and observer in order to teach each other topic-related concepts etc.
- **WebQuest**: WebQuest is an inquiry-oriented activity, where learners complete a task using (pre-selected) websites. Afterwards, learners' task results are evaluated.
- **Image Sharing**: Pre-service teacher students document practical teaching activities using images with captions. The image collection is shared with all class members.

Evaluators participating in phase II all received evaluation forms that were set up as described above. However, sixteen evaluators read all of the three selected teaching methods and for each they assigned a transfer confidence rating, while seventeen evaluators read and assigned transfer confidence ratings for a single teaching method. All evaluators filled out one form to suggest modifications to the template by eliminating or adding elements.

6.2.2 Results

During phase II of the evaluation, 22 confidence ratings for applying the Role Play teaching method, 21 confidence ratings for the WebQuest teaching method, and 22 confidence ratings for the Image Sharing teaching method were collected. Overall, there were 33 evaluations of modifying elements in the template.

Confidence ratings and comments regarding teaching methods. Regarding the confidence of evaluators in transferring the teaching methods into their own contexts, evaluators were most confident with the WebQuest teaching method (average confidence rating: 84%), followed by Role Play (67%) and Image Sharing (52%). Evaluators provided more than 300 highly diverse comments on the three teaching methods. As displayed in Table 3, all comments were classified into positive and negative comments (columns) and comments regarding the teaching method ("M" rows) vs. comments regarding the description of the teaching method ("D" rows). Surprisingly, even though WebQuest received the lowest number of positive comments on the method (25) and highest number of negative comments on the description (37), it is still by far rated best with respect to evaluators' confidence in applying this method in their own context.

Table 3: Frequencies and examples of positive and negative comments on teaching methods.

		Positive	Negative
WebQuest (*avg. confidence:* ***84%***)	**M**	*25 comments*; e.g. fosters reflection, self directed learning, self organization; easy to prepare; authenticity	23 comments; e.g. doesn't support teamwork; not easy to evaluate; may not engage the more able; requires computers; students may have difficulty in rating information sources
	D	*22 comments*; e.g. regarding graph. repr., goals/outcomes, references, activity descriptions; simple and clear	*37 comments*; e.g. no example, unsubstantiated assumptions, assessment unclear, some unclear activities; thumbnail → summary, copyright at the end

Role Play (*avg. confidence:* ***67%***)	**M**	*43 comments*; e.g. suitable for large groups; student are active and involved; teacher role benefits students; does not require a lot of planning	*25 comments*; e.g. artificial situation; problematic role of student as teacher; time consuming; difficult in large groups
	D	*11 comments*; e.g. brief, dense, generic, yet clear; reflection and student feedback important	*21 comments*; e.g. more detailed example needed, too general, assessment unclear; alternative → variation, learning outcomes unspecific
Image Sharing (*avg. confidence:* ***52%***)	**M**	*33 comments*; e.g. use of information sharing tools; collaboration support; motivating; applicable in a wide range of domains	*36 comments*; e.g. too much workload and resource requirements; assessment too traditional; confined to practical subject matters
	D	*14 comments*; e.g. regarding graph. repr., student feedback, title, learning outcomes, sequence description	*20 comments*; e.g. example missing, no references, activity descriptions unclear, learning outcomes unclear

'M' = comments regarding the teaching method;
'D' = comments regarding the description of the teaching method.

Elements suggested to be removed from the template. The evaluators suggested 15 distinct elements to be removed from the template, amounting to almost three quarters of all elements currently in the template. Eight elements received three or more nominations for removal. These elements are listed in Table 4, along with their number of nominations and examples of comments provided by evaluators.

Table 4: Elements proposed by evaluators to be removed from the description template including number of nominations and example comments.

Element	**#**	**Extracts from comment(s)**
Peer review	9	"Usually empty" — "It seems interesting, but not available" — "Not useful in any of the three cases" — "I do not understand what that is" – – "Might be very subjective"
Graphical representation	7	"Is repeated in sequence part" — "Too complicated for rather self speaking methods" — "I am used to other graphical representation, so I do not consider the current one very helpful or intuitive" — "Sketch or situation photo might be more helpful"
Alternatives	5	"Not very important" — "I cannot see how one can find alternatives – maybe variations" — "I should be able to find my own alternatives for my own settings"
Roles	5	"Do not need to be redefined separately if you already describe the activity first" — "Already described in the sequence of activities" —

Element	#	Extracts from comment(s)
		"The introduction makes it quite clear which roles are taken by whom, thus I think this point is just not necessary"
Comments	4	"Redundant to teacher reflection" — "Usually empty"
Duration	4	"Depending on the target group" (3x) — "The duration can be roughly estimated [by the reader]"
Subject/ discipline	4	"Redundant for this is the teacher's decision" — "The majority of methods will be independent from subjects or may be adapted to fit the required discipline"

As evident from Table 4, "peer review" received the most nominations (9) for removal. The problem with this element was that it was empty in all of the three selected teaching methods. Accordingly, some evaluators who suggested removing this element commented that "it was usually empty." If provided, this can be a useful element to have opinions of colleagues on the teaching method, e.g. regarding criteria of good teaching practice. One evaluator made a suggestion to rename this element to "evaluation of the method", which might be a more intuitive title for the element. Similar feedback was given regarding the elements "comments" and "student feedback" since they were also mostly empty in the teaching methods. Naturally, empty description elements are not seen as helpful.

The frequent votes for "graphical representation" to be removed came as a surprise, since this element was intended as a complementary visual representation of the "sequence of activities" to help readers get a quick overview and keep the overview while developing the teaching method. The frequent nominations for removal of this element may have been caused by the visualization using the software Graphical Learning Modeller[7]: All three of the selected teaching methods had a visualization using this software. Evaluators often mentioned that they could not interpret this particular activity diagram (e.g. they did not understand the icons used in the activities), which is specific to the software environment and not targeted towards general teaching method depictions. On a positive note, the evaluations of the teaching methods frequently contained comments in which evaluators mentioned that the graphical representation helped them to a better understanding by visualizing the sequence of activities, explaining the method and providing a quick overview.

The element "alternatives" seemed to have caused some confusion; as one evaluator commented, this should probably be called "variations" since the intent is to provide variations in the teaching method, not really alternatives to it. This was also suggested twice in the elements to be added to the template (see below). The "roles" element was also suggested to be removed, since the participating roles are evident from the description, e.g. in the "sequence of activities". Although seemingly redundant, including an element "roles" in the template allows providing a description of a role that would not have been provided in the sequence of activities. However, higher education instructors are not necessarily accustomed to defining roles in teaching situations (Neumann & Oberhuemer, 2009). Therefore, they may not feel that this element is useful to the description.

7 http://sourceforge.net/projects/prolix-glm

"Duration" and "subject/discipline" are—as mentioned by evaluators—heavily dependent on the actual implementation of the method in a specific context. However, these can be useful elements when searching and selecting teaching methods (Falconer et al., 2007).

Elements suggested to be added to the template. In addition to the elements proposed for removal, evaluators proposed more than twenty different elements they would like to see included in addition to the current set of elements. Among these, four elements were mentioned more than twice. These elements are listed in Table 5, along with number of nominations and example extracts from comments.

Almost half of the evaluators suggested descriptions of concrete examples to be included in the template. The teaching methods are described in a generic way, since it is important to distil properties of teaching practice that are transferable to other contexts (Conole, 2009). However, it is often difficult to imagine the method in practice without having concrete examples, and some studies found that practitioners prefer to implement teaching methods based on concrete examples rather than generic descriptions (Bennett, Agostinho, & Lockyer, 2005; Falconer & Littlejohn, 2009). We have deliberately not included an example section in the template. Our plan is to provide examples as *units of learning* alongside the generic teaching methods. As defined in Section 2, a unit of learning refers to a contextualized, complete, self-contained unit of education or training that consists of a teaching method and associated content (adapted from Olivier & Tattersall, 2005). One goal of our work is to create a repository of (generic) teaching methods, each paired with a number of concrete examples in the form of units of learning. This way, instructors could experience the unit of learning by playing it in a learning management system in order to gain an understanding of the unit's applicability.

Table 5: Elements proposed by evaluators to be added to the description template including number of nominations and example comments.

Element	#	Extracts from comment(s)
Examples	14	"Briefly described, it would clarify the method" — "Image of a real setup: to get it fast explained" — "Useful to have a comparison with a real case" — "Would make it easier to understand the teaching method" — "The general description helps to understand the idea […], but an example is very useful for the fine tuning"
Potential problems	5	"Key Issues: A section with main clues and critical issues" — "Threats/weaknesses of the teaching methods: To know, what could be a possibility for 'failure'" — "Liabilities/drawbacks: Is there anything that could go wrong?"
Background	4	"Description of the background (theory, research) to get a better insight" — "Foundations: […] the theoretical background of a method" — "Source: where does the method come from"
Preparation	3	"Preparation time and reusability: […] how much time [the teacher] will spend for this" — "Preparation and post-processing activities" — "What has to be done in advance by the teacher and students?"

The suggestions to include "potential problems", also referred to as "key issues" or "threats" by some evaluators, would help in giving useful hints for practitioners during implementation of the teaching method. The call for "background" on theory and foundations of a teaching method to be included in the template is certainly meaningful. The problem with such an element may be that it would presumably be empty in most teaching method descriptions, because collecting and presenting theoretical background information is a challenging and time-consuming task for authors. Also, the background information could be integrated into the summary, rationale, and other existing elements to support the description. Information on "preparation" for implementation was suggested by three evaluators. This seems to fit into the "teacher reflection" element. Two evaluators suggested to add "student skills" as a separate element. This may either suggest that not all evaluators have read the teaching method descriptions carefully, or it suggests that this information was missing in the "learner characteristics" or "learning outcomes" element of the respective teaching method. Depending on whether these evaluators referred to prerequisite or target skills of students when suggesting the additional element "student skills", we suggest including such information accordingly in the "learner characteristics" or "learning outcomes" elements.

6.3 Overall Evaluation Result

A look at the results of the two evaluation phases reveals an interesting observation: even though the template was considered highly complete by authors during phase I of the evaluation, participants in phase II provided numerous suggestions for modifying the template. Of the 22 participants, who provided evaluations of the appropriateness of the description template along with their description of a teaching method in phase I, 16 also participated as evaluators in phase II. As one would expect, those participants who judged the template to be complete in phase I had fewer suggestions for extension of the template in phase II: there is a significant negative correlation between the rating of completeness and the number of nominations for elements to be added to the template ($r = .54$, $p < .05$).

Nevertheless, the high number of suggestions by evaluators to extend the template in phase II clearly points to the fact that understanding teaching method descriptions written by someone else can be a difficult endeavour. One explanation could be that authors are using the template to provide "their own" teaching method, while the users are confronted with a representation provided by someone else, and thus may require additional information on issues that were clear or not worthy of mentioning to the author. Put another way, authors seem to be more likely to perceive a "lossless" transformation of their mental representation of a teaching method into written form than users trying to recreate a mental representation of the teaching method from the written descriptions. This could be due to the fact that authors closely connect the implementation context of the teaching method in their mental representation, even if they describe the method in a generic way. Users, however, just have the generic description and lack the information on the implementation context, making it harder to create a vivid representation.

In the light of WP3 goals, our main conclusion from this study is thus that the teaching method (when described using the description template) has to always be accompanied by a unit of learning that represents this teaching method. This has to be considered when storing teaching methods in an online repository. The repository should offer direct links to implementations of teaching methods. The unit of learning accompanying a generic teaching method aids the buildup of a mental representation.

6.3.1 Revised Teaching Method Description

Changes to the template. Based on the results of the two evaluation phases, and in light of the fact that the template will need to be represented by a metadata schema, we performed a revision of the description template. The following changes were made:

- Structurally, the template was reorganized into three sections: a third section titled "Comments" was introduced; this new section comprises elements that were previously attached to the detailed information section. However, the elements "Teacher reflection", "Student feedback", and "Peer review" are actually designed to include comments (or annotations) contributed by teachers and students, and do not represent the core information about the teaching method.
- The element "Name" was renamed to "Title". The example given was changed from Jigsaw to Brainstorming, because we figured that brainstorming as a teaching method is better known than jigsaw.
- "Author and copyright": This element was split up into two separate elements: "Author" and "Licensing model". The reason is that author is an atomic field in most metadata standards, and the licensing model, including notes on reuse, modification, and distribution represents more valuable information than the name of the copyright holder.
- "Summary/Thumbnail" was renamed to "Summary" since one of the evaluators pointed to the fact that most people associate a thumbnail with a small preview picture, which was not intended for this element.
- The description of the "Rationale for teaching method" element was revised to explicitly address the inclusion of theoretical background of the teaching method. The wish for more information on the theoretical background was indicated by several evaluators.
- "Subject/Discipline" was renamed to simply "Subject". This was also noted by one of the evaluators.
- The description of the "Learning outcomes" element was reformulated according to the definition of learning outcomes set forth in deliverable D2.1.
- The description of the "Duration" element was slightly adjusted to recognize the fact that information contained in this element will typically be based on the authors' estimate.
- Since some evaluators criticized the lack of an element to provide information on prerequisite knowledge, skills and competences of learners, the description of the "Learner characteristics" element was adjusted to help authors who are using the template include these informations within this element.
- The "Type of setting" element was renamed to "Setting". In addition, as some evaluators noted that many teaching methods can be implemented in several possible settings, we adjusted the element description to call for the *primary* setting of this teaching method.
- The "Type of assessment" element was renamed to "Assessment method", as this is a key concept used by WP6 to refer to the learning assessment in a teaching method or unit of learning.

- The "Alternatives" element was renamed to "Variations", since the actual intent of this element is to capture variations within the teaching method, and not alternatives to it. This was correctly brought up by several evaluators.
- Many evaluators complained that the template did not include any element related to real-world examples of implementations of the teaching method. This was accounted for by adding a new element named "Example implementations" to the detailed description section. This element can be used e.g. to connect the teaching method to descriptions of implementations or to units of learning.

The "Teaser" Section:

- **Title**: Title of teaching method. (*Example: Brainstorming*)
- **Author**: Name and optional contact information of the person who filled out this teaching method description. (*Example: Michael Derntl, University of Vienna, michael.derntl@univie.ac.at*)
- **Licensing model**: Information regarding the licensing model of this teaching method description. (*Example: Creative Commons Attribution-Share Alike 3.0*)
- **Summary**: Summary of teaching and learning activities in this teaching method; brief information about key points of the teaching method. (*Example: Ten-Plus-Two method is used to break long presentations. Instructor presents for ten minutes, learners then reflect two minutes. Repeat.*)
- **Rationale for teaching method**: Theoretical support and/or reasons for using this teaching method. (*Example: To foster active participation of and communication between students.*)
- **Subject**: In what (topical) area of study has this teaching method been used? (*Example: Civil engineering, geotechnics and hydraulic engineering*)
- **Learning outcomes**: Statements of what a learner knows, understands, and is able to do on completion of this teaching method. (*Example: Learners are able to calculate forces on dams.*)
- **Group size**: The approximate number of participants suitable for this teaching method. (*Example: The method is ideal for 15-20 participants, max. 30 participants*)
- **Duration**: The estimated amount of time it takes to complete the teaching method when it is being used/implemented. *(Example: 2 hours, if it is a large group 3 hours)*
- **Learner characteristics**: Description of the "target group" of this teaching method, i.e. the learners' prerequisite knowledge, skills, competences, age, level within the curriculum, special attributes, and/or qualities. (*Example: 15-35 years of age, introductory stage in college, high knowledge of technology*)
- **Setting**: The primary setting in which the teaching method is intended to be implemented. (*Example: online learning, blended learning, face-to-face*)

The "Detailed Information" Section:

- **Graphical representation**: A graphical depiction of the teaching method. (*Example: flow chart, activity diagram, swim lanes*)
- **Sequence of activities**: Detailed description of all activities (including assessment) performed by the participants as part of the teaching method as well as the activities'

temporal sequence. (*Example: 1. [Presenter] Present the concepts to be learned for ten minutes; 2. [Learner] Share and reflect together with another learner what has been presented in the last ten minutes; 3. [Presenter] Repeat steps 1 and 2 as necessary.*)

- **Roles**: Name and short description of roles that the participants take within the teaching method. (*Example: tutor, moderator, discussion participant, expert*)
- **Assessment method**: The intended method for assessing learners' progress and learning outcomes. (*Example: portfolio, multiple-choice test, oral exam*)
- **Resources**: Detailed description of the resources required for implementing the teaching method including room equipment, IT infrastructure, software, virtual learning environment, personnel resources, learning materials, and other supports. (*Example: flip chart, projector, forum or chat, at least 5 tutors, facilitator's toolkit, study guide*)
- **Variations**: Description of possible variations within the teaching method. (Example: To ensure that all participants contribute ideas during brainstorming, you may use note cards for collecting ideas instead of contributing ideas by shouting. Each participant writes their ideas on note cards and then shares them publicly.)
- **Example implementations**: References to example implementations of the teaching method, e.g. links to verbal descriptions, IMS LD units of learning, course websites. (Example: In "PandemicQuest" students research causes and solutions to pandemic diseases; see *http://imet.csus.edu/imet7/bressler/main/webmainb.htm*)
- **References**: Any references to the original source of the teaching method, background literature, or to resources used within the method. (*Example: Reigeluth, C.M. (1999). Elaboration Theory. In Reigeluth: Instructional Models - The New Paradigm. Mahwah, NJ: Lawrence Erlbaum.*)

The "Comments" Section:

- **Teacher reflection**: Description of experiences that teachers have had when implementing the teaching method, including benefits and opportunities, risks and threats. (*Example: Method works well when learners are active contributors. Preparatory effort of this method is high.*)
- **Student feedback**: Description of feedback that students have given when they learned with the teaching method. (*Example: Students liked the active participation during this method. Some students were afraid of the ill-structured nature of the method, because a lot of the responsibility is shifted to the students' side. This may cause discomfort.*)
- **Peer review**: Evaluation of the quality of the teaching method by a qualified peer or a colleague instructor. (*Example: The teaching method fulfils 8 of the 9 good practice criteria for teaching as identified by WP3 of the ICOPER project.*)

7 Instructional Modelling Support in Open ICOPER Content Space

The Open ICOPER Content Space (OICS; see D1.1) will act as the backbone infrastructure to enable the enactment of use cases by stakeholders. The interaction of stakeholders with key instructional modelling concepts is captured in the use cases that are presented in this section.

The key concepts provide the base layer within the ICOPER Reference Model (IRM; see D7.1), on top of which technical services are implemented to enable the realisation of ICOPER use cases and processes. One of the ICOPER key processes is planning and designing for learning and teaching. The central concepts identified for activities within this process are 'teaching method' and 'unit of learning'. The following sections outline the scenarios and use cases that demonstrate how stakeholders will be able to interact with those key concepts within the OICS.

7.1 Scenarios

All WP3 use cases are concerned with design-time user interactions with teaching methods and units of learning[8]. To enable the identification of the most relevant use cases, WP3 considers two core high-level scenarios of user interaction with TMs and UoLs within the ICOPER infrastructure:

Scenario 1: Develop a learning outcome oriented unit of learning
This scenario concerns user interactions with the goal of developing a new *unit of learning* either (a) based on existing *teaching methods* or units of learning or (b) from scratch. A typical sequence of steps in developing a learning outcome oriented unit of learning based on a teaching method could be the following:

1. Develop a teaching method based on learning outcomes and assessment
2. Document the teaching method using the teaching method description template
3. Share teaching method by uploading it to a teaching method repository
4. Select and assign content to the teaching method to create a unit of learning
5. Share unit of learning by uploading it to a UoL repository

Scenario 2: Reuse a unit of learning
This scenario concerns user interactions specifically intended to reuse existing units of learning. Three steps may be relevant in this scenario:

1. Searching for an existing unit of learning / teaching method in repositories
2. Adapting the teaching method / unit of learning to the own context
3. Newly created units of learning or teaching methods may be shared by uploading them to a repository

Optionally, comments, remarks, experiences during this scenario can be added as annotations to existing teaching methods and units of learning in the repository.

7.2 WP3 Core Use Cases

Figure 5 displays an overview model of the WP3 core use cases. Our only human actor / role is the *teacher* (or *learning designer*). In the use case descriptions we refer to this role simply as the '*user*'. To enable interaction with the repository, the user will use *tools* that support the use cases. Tools can be e.g., modelling tools, web interfaces, widgets, OICS user interfaces, and so forth[9]. 'Tool' is the non-human actor that is involved in all use cases, supporting access to the underlying OICS technical infrastructure. The use cases have been deliberately kept small and mostly independent of each other; they can be combined to achieve more complex interactions and scenarios.

[8] In this section, we use the following abbreviations: TM = Teaching Method, and UoL = Unit of Learning

[9] The concrete selection of tools within the OICS tool landscape will be subject to upcoming work in ICOPER.

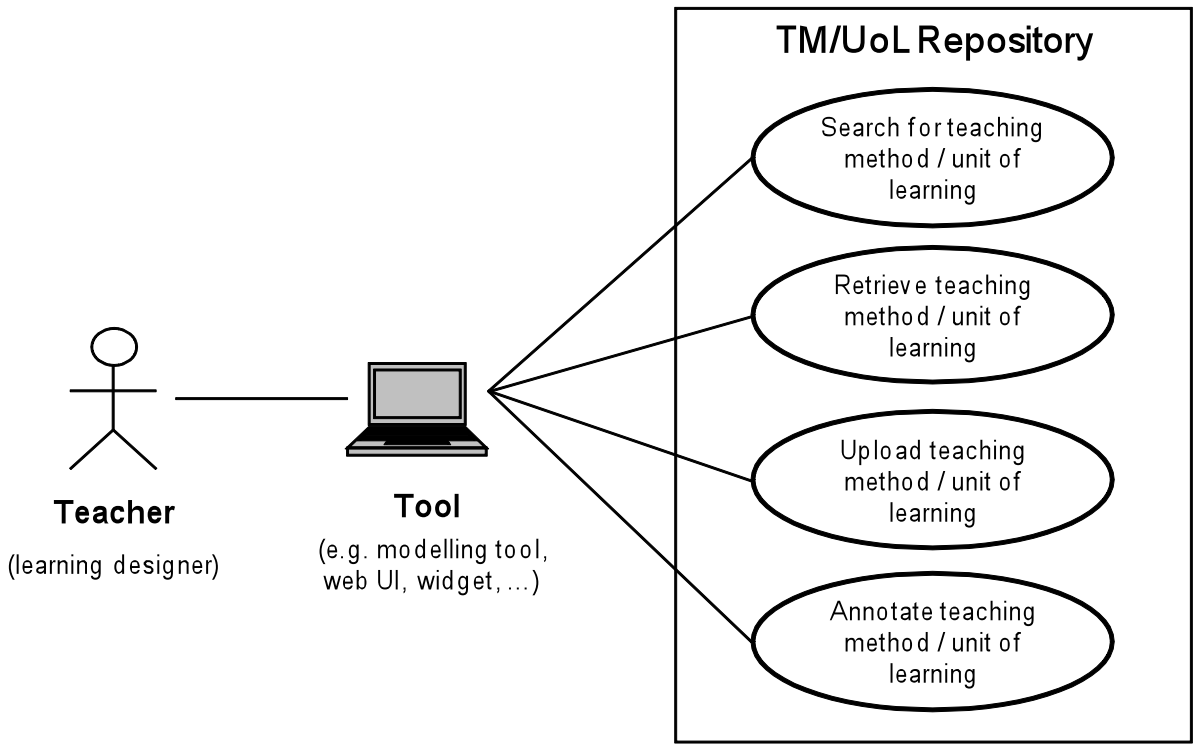

Figure 5: OICS use cases related to instructional modelling.

The use cases are described in detail and in no particular order below.

7.2.1 Search for TM/UoL

Goal:	The user aims to search for a desired TM/UoL.
Actors:	Teacher, Tool
Preconditions:	• The user has access a TM or UoL repository; the repositories are connected to the OICS • Availability of a tool (e.g., modelling tool, web interface, widget, OICS search UI) that provides a search interface
Description:	The user aims to search for a desired TM/UoL based on certain search criteria. The tool offers searching in all TM/UoL metadata elements. Related use case: if search is successful, the user may want to retrieve the TM/UoL (see use case "Retrieve TM/UoL") from the repository for further use.
Steps:	1. [User] logs into the repository and uses a search form to look up desired TM/UoL 2. [Tool] connects and sends the query to the repository 3. [Repository] searches for matching TM/UoL based on search criteria and returns the resulting list of TMs/UoLs 4. [Tool] presents the search results to the user and offers download of TM/UoL (see use case "Retrieve TM/UoL")

Results:	Success: • The user finds a relevant TM/UoL Failure: • The user doesn't find a relevant TM/UoL • The user finds an TM/UoL, which is irrelevant because of incorrect metadata
Variations:	–
Non-functional	• Efficiency: The search can be done in a reasonable amount of time • Effectiveness: The search results are relevant • Usability: The tool offers an intuitive and easy-to-use search interface for basic and advanced search
Remarks:	This use case is relevant for both interaction scenarios, i.e. for "Develop a learning-outcome oriented UoL" and "Reuse a UoL".

7.2.2 Retrieve TM/UoL

Goal:	The user aims to retrieve an existing TM/UoL.
Actors:	Teacher, Tool
Preconditions:	• The user is connected to the repository • Availability of a tool (e.g., modelling tool, web interface, widget, OICS search UI) to retrieve TM/UoL content from the repository
Description:	The user found a TM/UoL (see use case "Search for TM/UoL") and now aims to retrieve the desired TM/UoL. The tool offers downloading the TM/UoL content from the repository (or from any other location to which the metadata in the repository links to). If the TM/UoL is available in multiple formats (e.g. Word Document, PDF, ZIP) the tool offers choosing the desired target format. Related use case: the TM/UoL to be retrieved is found after a successful "Search for TM/UoL" use case.
Steps:	1. [User] selects the desired TM or UoL to be retrieved (e.g. from the result list of previous search). If the TM/UoL is available in multiple formats, the user selects the desired format 2. [Tool] retrieves (downloads) the TM/UoL from its storage location and offers to store and/or use it locally on the user's PC Note that the tool may offer further use of the retrieved TM/UoL, e.g. in an e-learning platform, in a modelling tool, etc.
Results:	Success: • The user has a downloaded copy of the TM/UoL Failure: • The download doesn't work (e.g. broken link) • The TM/UoL file is corrupt (e.g. transmission error) • The downloaded TM/UoL doesn't conform to its metadata • The tool doesn't know how to handle the TM/UoL content format
Variations:	–

Non-functional	• Efficiency: The retrieval can be done in a reasonable amount of time (given the size of the TM/UoL contents) • Effectiveness: The retrieved TM/UoL data is in the correct format and conforms to its metadata • Usability: The tool offers an intuitive and easy-to-use retrieval interface, e.g. one that is integrated in the search results list.
Remarks:	• This use case is relevant primarily for Scenario 2, i.e. "Reuse a UoL". • The tool may offer further options to work with the retrieved TM/UoL. For instance, an IMS LD modelling tool may offer to import, visualize and modify retrieved IMS LD compliant UoLs; or an LMS might offer to import an IMS LD compliant UoL.

7.2.3 Upload TM/UoL

Goal:	The user aims contribute a TM/UoL by uploading it into the repository
Actors:	Teacher, Tool
Preconditions:	• The user has a TM/UoL (i.e., content and relevant metadata) available to upload to the repository • The has write access to the repository • Availability of a tool (e.g., modelling tool, web interface, widget, OICS search UI) to upload content and/or metadata to the repository.
Description:	The user wants to upload a new TM/UoL to the repository. The TM/UoL may have been created from scratch, by modifying an existing UoL, or by discovering an existing TM/UoL that is not yet stored in the repository. The tool offers uploading the TM/UoL content and supplying required metadata; the tool may offer help by automatically extracting metadata from the TM/UoL content file(s).
Steps:	1. [User] selects the TM/UoL to be uploaded from his/her local machine 2. [Tool] presents the user a form or wizard to be completed with metadata; optimally, the tool detects the format of the TM/UoL files and automatically extracts as many metadata elements as possible. 3. [User] completes the TM/UoL metadata and then commits the upload 4. [Tool] connects to the repository and uploads the TM/UoL and its metadata
Results:	Success: • The TM/UoL is successfully uploaded to the repository and is subsequently available to other users. Failure: • The upload doesn't work (e.g. protocol error) • The metadata is invalid (e.g., doesn't conform to the application profile, or is incorrect with respect to the TM/UoL contents) • There is a conflict with an existing TM/UoL in the repository

Variations:	Upon successful upload (or even during the provision of metadata by the user), a new TM may be linked to an existing UoL (or vice versa); see use case "Annotate TM/UoL"
Non-functional	• Efficiency: The upload and the process of providing metadata can be done in a reasonable amount of time. • Effectiveness: The uploaded TM/UoL is stored and subsequently searchable and retrievable • Usability: The tool offers an intuitive and easy-to-use interface for providing/selecting metadata and content

Remarks:	• This use case is relevant for both interaction scenarios, i.e. "Develop a learning outcome oriented UoL" and "Reuse a UoL".
	• The UI offered by the tool for uploading the TM/UoL should offer easy linking of the new TM/UoL to:
	  ○ relevant learning outcomes that are addressed by the TM/UoL
	  ○ related TMs/UoLs that are already in the repository
	• For increased usability the upload should be integrated in the typical workflow of the tool used to upload the TM/UoL, e.g.
	  ○ An LMS may offer to upload a completed course; many metadata elements should already be available here;
	  ○ An IMS LD modelling tool may offer an option to export an IMS LD compliant content package and upload it to a UoL repository.

7.2.4 Annotate TM/UoL

Goal:	The user aims share annotations (e.g. metadata annotations or personal annotations like comments) to an existing TM/UoL.
Actors:	Teacher, Tool
Preconditions:	• The user can identify an existing TM/UoL, which he/she wants to annotate • The user has the necessary rights to annotate existing TMs/UoLs in the repository • Availability of a tool (e.g., modelling tool, web interface, widget, OICS search UI) to create the annotations
Description:	The user aims to annotate an existing TM/UoL with comments, (e.g., teacher reflections, peer review, student feedback), related TMs/UoLs, etc. This is a generic use case, that captures any interaction where metadata of an existing TM/UoL is annotated by a user of the repository. Related use case: existing TMs/UoLs are found through use case "Search for TM/UoL"
Steps:	1. [User] is connected to a repository and selects a TM/UoL to be annotated (e.g. through use case "Search for TM/UoL"); the tool he/she uses to connect to the repository offers a means to create annotations to the TM/UoL. 2. [Repository] stores the annotation in the metadata

Results:	Success: • TM/UoL was successfully annotated • The annotation is visible to other users Failure: • Annotation is invisible to other users • Annotation cannot be added • There is no appropriate metadata field to store the desired annotation
Variations:	There are several thinkable variations of this use case; three of the most relevant, concrete annotation use cases are defined as follows: Variant A — "*Add comments to TM/UoL*": Teaching method descriptions may include user annotations in the comment section of the description template. These annotations include *teacher reflections* (after re-using a TM/UoL), *peer review* (of the quality of the TM/UoL description) or *student feedback* (collected during the implementation of the TM/UoL). Variant B — "*Link TM with UoL*": This variant includes all interactions of users with the repository, where TMs are linked with existing TMs/UoLs or vice versa. For example, a user may annotate TM "*Academic Writing*" with the information that this TM is implemented in the UoL "*Scientific Writing in Computer Science*". Variant C — "*Link TM/UoL with learning outcome*": This variant deals with interactions where a user assigns learning outcomes to a TM or UoL. During this interaction, the assigned learning outcome definitions are added to the metadata record of the TM/UoL (see also deliverable D2.2).
Non-functional	• Efficiency: The annotation can be done in a reasonable amount of time • Effectiveness: The annotation is stored in the TM/UoL metadata • Usability: The tool offers an intuitive and easy-to-use interface for annotating a TM/UoL
Remarks:	This is This use case is primarily relevant after Scenario 2, "Reuse a UoL," e.g. where the user may want to share implementation experiences; it is also relevant to other interactions where users may want to link TMs with UoLs and vice versa.

7.3 Metadata for Teaching Methods and Units of Learning

To enable implementation of the above described use cases within shared, interoperable repositories, a metadata schema for describing teaching methods and units of learning is required. As displayed in Figure 6 the teaching method metadata and the unit of learning metadata will be stored in one or more metadata repositories within the OICS. The teaching method descriptions and the units of learning (some of which will be IMS LD compliant) may be stored in one or more distributed object repositories.

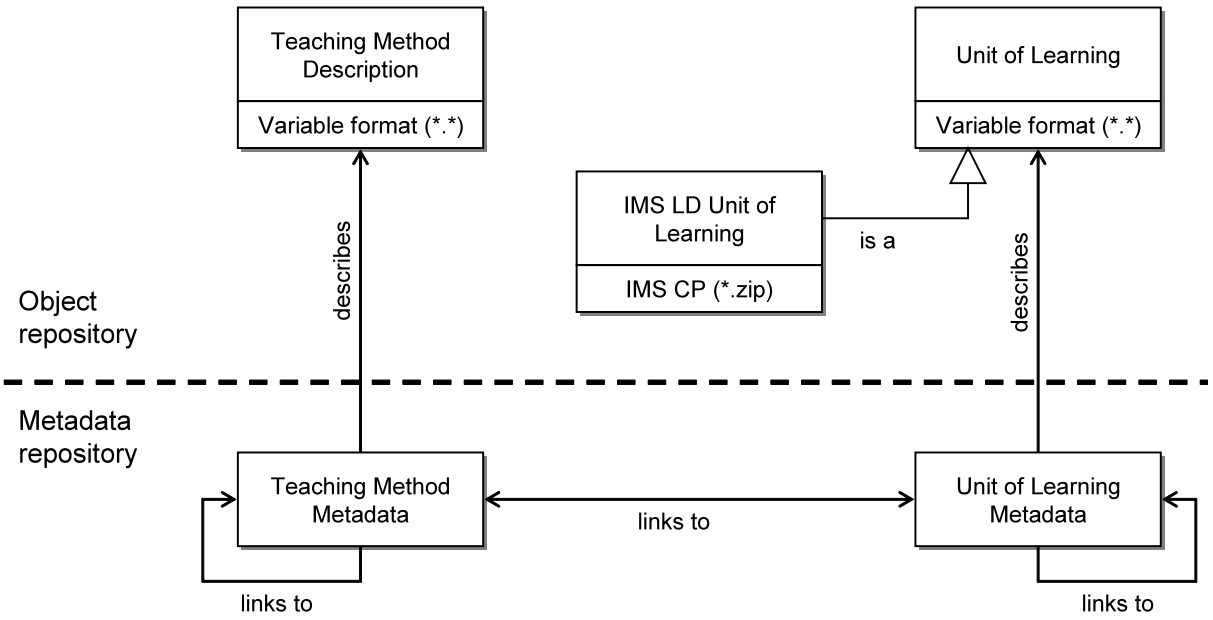

Figure 6: Conceptual model of teaching methods, units of learning, and their metadata.

We made the decision to build the TM/UoL metadata on existing standards. Therefore we investigated the suitability of two of the most prominent metadata standards in education, i.e. LOM and Dublin Core, as base standards for developing an application profile for TM/UoL metadata. The primary requirement was that the selected standard shall provide broad built-in support for descriptive elements in the teaser section of the teaching method description template. These elements include: Title, Author, Licensing, Summary, Rationale, Subject, Learning Outcomes, Group Size, Duration, Learner Characteristics, and Setting. Additional elements of interest in the template were Roles, Assessment Method, Example Implementations, and Comments.

- **Dublin Core (DC)**[10] is one of the most widely used metadata standards. Its current version is defined in ISO standard 15836:2009 (ISO, 2009). DC is a cross-domain standard for describing digital materials, e.g. text, video, images, sound, and so forth. Its basic metadata element set includes fifteen elements: Title, Creator, Subject, Description, Publisher, Contributor, Date, Type, Format, Identifier, Source, Language, Relation, Coverage, and Rights. This set of elements is very general and can thus be used on many different types of digital resource. For describing teaching methods and units of learning, the set of elements would need to be extended considerably. In particular, elements pertaining to instructional intent, use and target group characteristics are completely missing.

- **Dublin Core Educational (DC-Ed)**[11] is a DC application profile developed by the DC Education Working Group. The current draft specifies a number of additional elements, including e.g. Audience, Education Level, Instructional Method, and Subject. Use of this metadata schema would still require several extensions to represent the teaser elements in the teaching method description template.

10 See http://www.dcmi.org

11 See http://projects.ischool.washington.edu/sasutton/dcmi/DC-EdAP-7-18-06.html

- **Learning Object Metadata (LOM)**[12]. LOM is a metadata standard for learning objects defined by IEEE Standard 1484.12.1 (IEEE, 2002). The standard defines an extensive set of metadata elements that are grouped into nine different categories (General, Life Cycle, Meta-metadata, Technical, Educational, Rights, Relation, Annotation, and Classification). The categories and elements available in the LOM standard provide the most extensive coverage of teaching method and unit of learning metadata. In addition, it provides built-in points for extension in the Relation, Classification, and Annotation categories; these can be used, e.g. to link teaching methods with units of learning, or to add user annotations to metadata. Also, the definition of *learning object* provided by IEEE is very broad; it accommodates "any entity, digital or non-digital, that may be used for learning, education, or training." (IEEE, 2002, p. 3). Therefore we decided to take LOM as the base standard for developing a metadata application profile for teaching methods and units of learning. Please see Annex D for a draft definition of the complete LOM application profile.

8 Summary and Further Work

The objectives of ICOPER's WP3 are:

- to capture and evaluate good teaching practice in instructional modelling with respect to the development of sound recommendations and better practice (incorporating results of related instructional modelling initiatives); and
- to investigate the potential and suitability of the IMS LD specification for design-time and support of teaching practitioners, instructional designers, and other stakeholders in instructional modelling.

To achieve these objectives we proceeded as follows. First, we investigated how teaching practitioners and related instructional modelling initiatives approached the documentation and reuse of teaching practice. We found that while many initiatives previously tackled this issue, there is still no widely accepted and adopted way of documenting teaching methods for reuse. Based on the results of previous initiatives—most notably the JISC funded Mod4L project—we conceived a new description template for structured documentation of generic teaching methods. The template was evaluated with practitioner involvement and revised accordingly. To link generic teaching methods to concrete examples we adopted the concept of unit of learning as a contextualised, complete unit of education or training including subject-specific content. Within the Open ICOPER Content Space (OICS) some of these units of learning will be provided in IMS LD compliant form, and integrated with artefacts provided by other core ICOPER work packages, such as assessment (WP6), learning outcomes (WP2), content (WP4), and delivery environment (WP5). This integration of concepts to enable interoperability in OICS was achieved by creating an initial version of a LOM application profile for teaching methods and units of learning. Another purpose of the LOM profile is the support of the interaction of instructional modelling stakeholders with teaching methods and units of learning within OICS; these interactions were captured in five main use cases, allowing searching, retrieving, uploading, annotating and linking teaching methods and units of learning based on LOM metadata.

To enable the identification and classification of better practice we presented our vision of an *ICOPER Framework for Good Teaching Practice*, which is built on four pillars:

12 See http://dx.doi.org/10.1109/IEEESTD.2002.94128 or http://ltsc.ieee.org

1. Teaching methods as generic examples of good teaching practice, documented by the teaching method description template;
2. Units of learning as contextualized, concrete implementations of teaching methods;
3. Criteria for good teaching practice, which enable identification and development of good teaching examples; and
4. The Educational Taxonomy, which will act as a handy tool for classification of teaching methods and units of learning, e.g. for easier searching.

In respect of future work in ICOPER, this Framework will guide the way towards examining the potential of IMS LD to express a wide range of teaching methods and units of learning and towards supporting the conversion between generic and contextualized exemplars of good teaching practice. Additonally it is intended to act as a handy tool in and beyond ICOPER to propel the uptake of instructional modelling for good teaching practice in the European context.

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Annex A: Grouping Good Teaching Principles into Nine Criteria

This annex shows the exact matching of the principles included in other good teaching practice initiatives as they were summarized into the nine criteria as introduced in section 4.2. To identify the original principle, we used abbreviations. The link to a principle's original source can be tracked by using the abbreviation listed below and the number. For instance, PSU#3 is the third principle listed on the Best Teaching Practices at Penn State University.

- Best Teaching Practice at Penn State University (short: PSU)
- Fink's Five Principles of Good Course Design (short: FINK)
- Guidelines for Good Teaching Practice at University of New South Wales (short: NSW)
- High Quality Learning Designs by the AUTC Project, University of Wollongong (short: GONG)
- Seven Principles of Good Teaching Practice by Chickering & Gamson (short: 7PGP)
- Six Key Principles of Effective Teaching in Higher Education by Ramsden (short: SKP)
- The Seven Step Program for eLearning Improvement (short: QUINN)

Prepare (for) learning

- *Prepare and communicate the agenda for learning including goals, expectations, and grading*
- *Create interest in students for the topic to be learned*
    - Examples from sources:
        - Interest and explanation (SKP#1)
        - Clear goals and intellectual challenge (SKP]#4)
        - Clearly articulated expectations, goals, learning outcomes, and course requirements increase student motivation and improve learning. (NSW#10)
        - Good practice communicates high expectations. (7PGP#6)
        - Carefully explaining course goals, expectations, grading and ground rules at the beginning of the course (PSU#4)
        - Having a formal agenda (schedule of goals and topics) for each class session (PSU#8)
        - Have a learning objective to change the skill-set of the learner, not just address their knowledge (QUINN#1)
        - Help learners see why it (the learning) is important to them, and set expectations about what's to come (e.g. hard stretch is up next). (QUINN#3)

Incorporate learners' backgrounds, experiences and expectations

- *Set up the learning so that it incorporates student's prior experiences and knowledge*
- *Tailor the learning to student's expectations*
    - Examples from sources:
        - Learning is more effective when students' prior experience and knowledge are recognised and built on. (NSW#5)
        - The educational experiences of all students are enhanced when the diversity of their experiences are acknowledged, valued, and drawn on in learning and teaching approaches and activities. (NSW#8)
        - Engage learners: Considering learners' prior knowledge and their desires and building on their expectations. (GONG#1)
        - Good practice respects diversity -- talents, experience, and ways of learning. (7PGP#7)
        - Concern and respect for students and student learning (SKP#2)

        - Engage the learners' interests, provide the personal value, and set expectations. (QUINN#3)

Connect learning to a (larger) context

- *Draw connections between the learning experience and contexts, in which the learning is or will be relevant*
    - Examples from sources:
        - Acknowledge learner context: Considering how the implementation of the learning design (be it a one class session, over the period of a few weeks, or the entire subject) is positioned within the broader program of study for the learner. (GONG#2)
        - Students become more engaged in the learning process if they can see the relevance of their studies to professional, disciplinary and/or personal contexts. (NSW#6)
        - Graduate attributes – the qualities and skills the university hopes its students will develop as a result of their university studies – are most effectively acquired in a disciplinary context. (NSW#12)
        - Provide closure. Reconnect what learners have been doing to the larger (working) context of why this is important. (QUINN#7)

Challenge learners

- *Involve learners in learning activities that are challenging to them and foster their higher order thinking skills*
    - Examples from sources:
        - Effective learning is supported by a climate of inquiry where students feel appropriately challenged and activities are linked to research and scholarship. (NSW#2)
        - Challenges students to HIGHER LEVEL LEARNING. (FINK#1)
        - Challenge learners: Seeking the active participation of learners, encouraging learners to be self-critical and supporting learners' ampliative skills. (GONG#3)
        - (Clear goals and) intellectual challenge (SKP#4)
        - Activities that are interesting and challenging, but which also create opportunities for students to have fun, can enhance the learning experience. (NSW#3)
        - When students are encouraged to take responsibility for their own learning, they are more likely to develop higher-order thinking skills such as analysis, synthesis, and evaluation. (NSW#11)
        - The ideal practice is contextualized, meaningful to the learner, sufficiently challenging, and plays out in a full story. (QUINN#6)

Employ multiple teaching methods

- *Include different activities and methods during learning to foster different skills and cater to different learning styles*
    - Examples from sources:
        - Students learn in different ways and their learning can be better supported by the use of multiple teaching methods and modes of instruction (visual, auditory, kinaesthetic, and read/write). (NSW#9)
        - Uses (a STRUCTURED SEQUENCE OF) DIFFERENT LEARNING ACTIVITIES. (FINK#4)

        - Structured occasions for reflection allow students to explore their experiences, challenge current beliefs, and develop new practices and understandings. (NSW#4)
        - Help learners understand how the concept applies to multiple contexts unless there is only one exact situation for application. This supports transfer. Highlight mistakes and ways to repair. (QUINN#5)

Actively engage learners in learning

- *Involve learners in learning by including activities that place students in active roles and lets them practice*
    - Examples from sources:
        - Effective learning is supported when students are actively engaged in the learning process. (NSW#1)
        - Uses ACTIVE FORMS OF LEARNING. (FINK#2)
        - Good practice uses active learning techniques. (7PGP#3)
        - Provide practice: Encouraging learners to articulate and demonstrate to themselves and their peers what they are learning. (GONG#4)
        - Independence, control, and active engagement (SKP#5)
        - Effective learning is facilitated by assessment practices and other student learning activities that are designed to support the achievement of desired learning outcomes. (NSW#15)

Facilitate interaction and collaboration

- *Arrange interactions between learners and faculty and among learners themselves*
- *Provide opportunities for learners to work collaboratively*
    - Examples from sources:
        - Incorporating group discussion activities as part of each class session (PSU#9)
        - Good practice encourages interaction between students and faculty (7PGP#1)
        - Good practice encourages interaction and collaboration between students (7PGP#2)
        - If dialogue is encouraged between students and teachers and among students (in and out of class), thus creating a community of learners, student motivation and engagement can be increased. (NSW#7)
        - Learning cooperatively with peers - rather than in an individualistic or competitive way - may help students to develop interpersonal, professional, and cognitive skills to a higher level. (NSW#14)

Give feedback & include appropriate assessment

- *Provide feedback to learners that is frequent and timely*
- *Provide assessment opportunities that are targeted towards the learning outcomes*
    - Examples from sources:
        - Appropriate assessment and feedback (SKP#3)
        - Effective learning is facilitated by assessment practices and other student learning activities that are designed to support the achievement of desired learning outcomes. (NSW#15)
        - Meaningful and timely feedback to students improves learning. (NSW#16)
        - Gives FREQUENT and IMMEDIATE FEEDBACK to students on the quality of their learning. (FINK#3)

        - Has a FAIR SYSTEM FOR ASSESSING AND GRADING STUDENTS. (FINK#5)
        - Giving students an opportunity to revise assignments before a final grade is given (PSU#7)
        - Good practice gives prompt feedback. (7PGP#4)
        - Promptly reviewing homework, exams, assignments, etc. (PSU#5)
        - Helping students prepare for exams by offering special study sessions (PSU#2)

Collect feedback from learners

- *Collect feedback from learners to judge learners' knowledge levels and to find ways to improve your teaching*
    - Examples from sources:
        - Collecting student feedback on a regular basis to determine what was learned, what was confusing, etc. (PSU#3)
        - Learning from students (SKP#6)

Principles that were not included in any of the above criteria

The following criteria were not recognized in any of the groups named above. They are listed here for completeness:

- Providing examples of "superior", exam answers, "excellent" projects, and "A" papers (PSU#6)
- Giving lectures that are clear and well-organized (PSU#1)
- Learning can be enhanced and independent learning skills developed through appropriate use of information and communication technologies. (NSW#13)
- Good practice emphasizes time on task. (7PGP#5)
- Help learners focus on the key words in a setence. Cut texts by reducing elegant prose, and highlight the essence of information using bold, italics, bullets etc. (QUINN#2)
- Elaborate concepts into a meaningful rationale, multiply represented, model-based. (QUINN#4)
- *Not recognized for the "structure sequence" portion:* Uses a STRUCTURED SEQUENCE OF (DIFFERENT) LEARNING ACTIVITIES. (FINK#4)

Annex B: Example of a Completed Teaching Method Description

A teaching method that was described by one of the evaluators is contained here.

Image Sharing

Teaching Method

Author & Copyright:

Author: **BLINDED**

Copyright: Creative Commons

Summary/Thumbnail:

This activity is used to help students document practical teaching activities using images with captions. The image collection can then be shared with all class members.

Rationale for teaching method:

Images are useful means of recording visual aspects of a practical activity which pre-service teachers are undertaking with a class. The also provide evidence of what occurred and can be useful a triggering memories of the situation.

Subject/Discipline:

Education, but may be adaptable to other disciplines in which visuals are relevant

Learning outcomes:

1. Create a visual record of a teaching activity
2. Select images to share on a class database and provide explanatory captions

Group size:

Ideal size 15 students

Duration:

2 hours in addition to time taken to collect images during the teaching activity

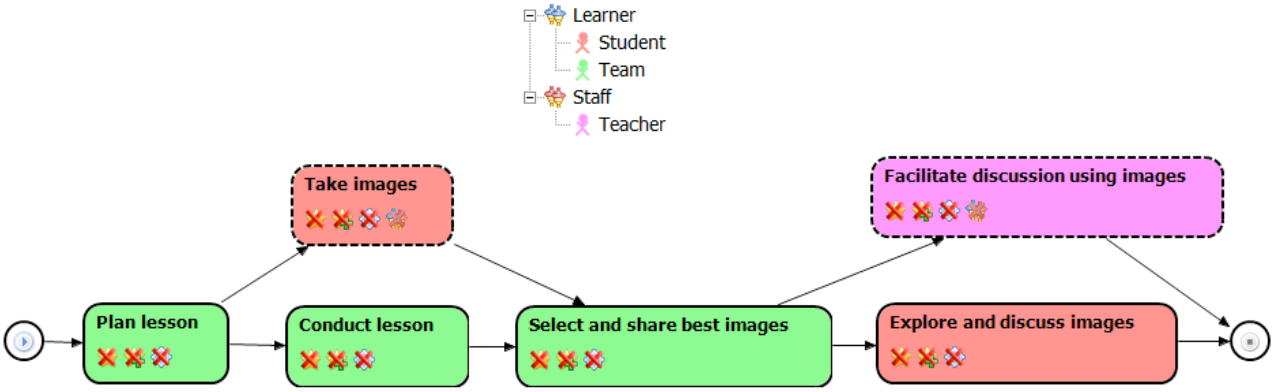
Learner Characteristics:

Higher education students

Type of Setting:

Adaptable to any mode but best suited to face-to-face classes

Graphical Representation:



Sequence of Activities:

1. Students are grouped into pairs or small teams and plan a teaching activity to be conducted with school students.
2. The lesson is conducted with one or members of the team taking photos during the session.
3. The pairs/teams select the best images from the set taken and share them online using image sharing software, providing an explanatory caption for each.
4. All class members explore the class image database.
5. The teacher uses the images as stimuli to facilitate a discussion about the teaching experiences amongst the group.

Roles:

The students collaborate to assist each other in teaching and recording the activity.
The teacher provides support and facilitation.

Type of Assessment:

The teacher can choose to assess the students' contributions to the database (i.e. the suitability of the images and completeness of the captions) and may also require students to prepare a written report using the images which could then be assessed.

Resources:

- Image sharing software, students accounts and membership of a private group space
- Access to a computer lab
- Digital cameras and batteries

Alternatives:

The teacher could extend the use of the image database. For example, have students vote on their favorite images (i.e. the ones they think best depict the activities). Or the learners could write individual reflections based on the images about what they learned through the experience.

Teacher Reflection:

The activity works well when the students are given clear guidelines about what they should photograph and how to describe their images as representing their experiences. It may also be advisable to provide model answers. Otherwise the danger is that students can be just descriptive without reflecting much on their experience in depth.

Student feedback:

Students actively participate in the task when they feel confident they know what is expected. Students have also said that they sometimes struggle to relate the task to the content or practical knowledge they are supposed to develop. This requires guidance from the teacher.

Peer Review:

The method has not been peer reviewed.

Comments:

None.

References:

None.

Annex C: List of Teaching Methods

The following list includes all teaching methods collected in Phase I of the evaluation of the teaching method description template (see Section 6.1). For each teaching method, the list includes the title and brief summary provided by the author.

- **3 Times 3 Things Learnt**: a simple procedure to review issues from a unit of learning. Each learner notes three answers for three categories of learning topics. The notes may be shared with the whole group of learners.
- **Active Learning**: Learners propose, plan, execute, and evaluate a project that requires the application of knowledge from educational science. The setting of the project is the learners' actual work environment. Guidance is provided both at the working place and at the distance university.
- **Blogging**: Students download and set-up a Wordpress blog. They create custom categories, change themes, and install plug-ins. Practical work with the blog is to identify, describe and reflect upon how blogs can be used in educational contexts. Students use the blog to document the personal learning experience while working with the assignment.
- **Brainstorming and Reflection**: Brainstorming and Reflection is used to introduce new concepts and definitions that "seem familiar" to students but are not (yet) exactly and accurately defined, by brainstorming, raising ideas by shouting, and discussing the issues in the whole group.
- **Competitive Simulation**: After the instructor shortly presents the context, learners engage with a simulation and make decisions in the environment of the simulation. In the end, learners present their results of engaging with the simulation and demonstrate their results and understanding of the system in a presentation.
- **Constellation**: Constellation is used in the context of courses as an icebreaker and socializing game. In the back of the classroom, the participants are asked to choose their standing place according to their answers to questions asked by the instructor (e.g. length of study, distance to university, and experience with project management).
- **Creative Workshops**: The key point is to foster creative thinking in groups of teachers, developers and often students to produce innovative and effective learning designs. These designs are usually linked to a specific learning object that will embed and implement the design.
- **Creation of Personalized Learning Environments**: To foster active use and design of Personal Learning Environments (PLE's)
- **Cultura**: Cultura provides a methodology for second language and culture acquisition through cultural mirroring, collaboration, and reciprocal peer tutoring.
- **Cultural Awareness**: An approach to facilitate groups in cross-border content re-use. Additionally, this method focuses on improving and localizing materials as part of the learning process.
- **E-Portfolio**: EPortfolio is a dynamic tool to collect the evidences of our own personnal development. An e-portfolio can be seen as a type of learning record that provides actual evidence of achievement.
- **Exercise Unit**: Search, write and present two visualization examples.

- **Games Genre**: Learners research different games and analyse games for their educational purpose, i.e. how and when to include these games in an educational setting. Learners discuss their analyses in forums.
- **Presenting Homework**: For each lesson a student prepares the homework for presentation in front of the class (e.g. via Powerpoint and beamer, overhead transparency, etc.). The presentation should include both the description of the process and the final product of the homework. During the presentation students and teacher can ask questions and discuss or contribute alternative solutions and strategies.
- **Image Sharing**: This activity is used to help students document practical teaching activities using images with captions. The image collection can then be shared with all class members
- **Implement a Suggestion**: This method is used to setting-up an experiment, to make measurements and recording the findings with the support of a facilitator.
- **In-class Online Discussion**: A synchronous online discussion to be held in regular workshops to discuss a pre-determined question reflecting the course readings and lectures.
- **Listen – Do – Reflect**: Presentations of instructors are followed by hands-on exercises (exercise sheets, role plays, etc.) where learners use the previously presented information and reflect on their experiences and performance (which can optionally be captured on video).
- **Ten-Plus-Two Variation**: A method similar to the "Ten Plus Two methods" is used where a 15 minute power point presentation is shown, then discussion. This continues for 2 teaching periods (50 minutes each) with a ten minute break. Then a film is shown for 10 minutes and this serves as a case study which opens up a discussion. In the event that a film is not available on the issue discussed, then a written case study is given out for discussion. This process is followed by a set of questions which a given to the students who are now into groups of 3-4 for discussion
- **Mini Conference**: Students are required to attend three [authentic] academic conferences (organized by the faculty or chosen independently) and to write conference reviews three times.
- **Modeling**: The main goal of the modeling teaching method is to train learners to solve problems autonomously.
- **Online Reaction Sheets**: Reaction sheets are used to collect students' feedback and to share it between all participants. The reaction sheets are likely to have an influence on the follow-up units.
- **Online Training**: Online trainings allow the participation at trainings from anywhere. If the training is recorded, students can access the materials later on at any time
- **Peer-to-Peer Teaching**: Peer-to-peer teaching is used to facilitate the learning of concepts and to engage students in discussion.
- **Peer Assessment**: Peer assessment is based on the idea that students assess their peers' work in order to enhance students' interpretation and reflection.
- **Process-based Assessment**: Students take responsibility for their own learning process, create their own learning goals, document and reflect on their learning process together with other students and/or teachers.

- **Process Documentation**: The aim with the process documentation is to increase the students' awareness of their own acquisition of knowledge and that his/her learning process is different in different assignments of the course. The purpose is also to test formative examination which is one of many forms of examination in distance- and flexible learning.
- **Project-based Learning**: The activities of this teaching method involve the development of an authentic engineering project. Instructors provide a specification of a project that has to be developed. The learners will work in groups to carry out the project.
- **Resource-based Analysis**: Divided in groups, students work and compete to analyze a design problem, managing their available resources.
- **Role Play**: Students in groups of 3, each take a role of 'Teacher', 'Student', or 'Observer'.
- **Student Wiki Collaboration**: Students work in small groups on a particular problem. All details of the work and the procedure are organized by themselves. Their results shall be published in a Wiki. Finally, short presentations face-to-face are given. Participation is voluntary.
- **World Café**: World Café is used to collect common knowledge within a group and to share prior knowledge.
- **WebQuest**: WebQuest is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests focus on learners using information rather than looking for it, and support learners' thinking at the levels of analysis, synthesis, and evaluation. In the WebQuest, learners are presented with a task and will complete this task using (preselected) websites. An evaluation of the learners' task results completes the WebQuest.

Annex D: LOM Elements for Teaching Methods and Units of Learning

Note: **BOLD ALL CAPS** in the "Teaching Method Metadata Information" column indicates a field defined in the teaching method description template.

Nr	Name	Size	LOM Element Information	Teaching Method Metadata Information	Unit of Learning Metadata Information	Value Space	Datatype	Obligation TM / UoL
1	General	1	This category groups the general information that describes this learning object as a whole				(CATEGORY)	M / M
1.1	Identifier	spm=10	A globally unique label that identifies this LO				(CONTAINER)	M / M
1.1.1	Catalog	1	The name or designator for the identification or cataloging scheme for this entry. A namespace scheme.	TBD: depends on OICS policy	TBD: depends on OICS policy		Charstring	M / M
1.1.2	Entry	1	The value of the identifier within the identification or cataloging scheme that designates or identifies this learning object. A namespace specific string.	TBD: depends on OICS policy	TBD: depends on OICS policy		Charstring	M / M
1.2	Title	1	Name given to this learning object	**TITLE**: Title of the teaching method.	Title of the unit of learning.		Langstring	M / M
1.3	Language	spm=10	The primary human language or langauges used witin this learning object to communicate to the intended user.	Language of teaching method description.	Language of the description of the unit of learning.	ISO 639:1988 (langcode) and ISO 3166-1:1997 (optional subcode)	Charstring	R / R
1.4	Description	spm=10	A textual description of the content of this learning object.	**SUMMARY**: Summary of teaching and learning activities in this teaching method; brief information about key points of the teaching method.	A textual description of this unit of learning.		Langstring	M / M
2	Life Cycle	1	This category describes the history and current state of this learning object and those entities that have				(CATEGORY)	M / M

			affected this learning object during its evolution.					
2.1	Version	1	The edition of this learning object.	Version of teaching method description.	Version of unit-of-learning description.		Langstring	O / O
2.3	Contribute	spm=30	Those entities that have contributed to the state of this lerning object during ist life cycle.	Should at least include **AUTHOR**: Name and optional contact information of the person who created this teaching method.	Should at least include the author of the person who created this unit of learning.		(CONTAINER)	M / M
2.3.1	Role	1	Kind of contribution.	= "author"	= "author"	author	Vocabulary	M / M
2.3.2	Entity	spm=40	Entity or entities contributing to this learning object.	Author details	Author details	vCard	Charstring	M / M
4	Technical	1	Technical requirements and characteristics of this learning object				(CATEGORY)	M / M
4.1	Format	spm=40	Technical datatype(s) of all components of this LO	File format of teaching method description	File format of the unit of learning	MIME type	Charstring	M / M
4.2	Size	1	Size in bytes (uncompressed)	Size in bytes (uncompressed)	Size in bytes (uncompressed)	Number	Charstring	R / R
4.3	Location	spm=10	Location of the LO	URL to retrieve teaching method description	URL to retrieve unit of learning	URL	Charstring	M / M
5	Educational	1	Key educational or pedagogic characteristics of LO				(CATEGORY)	
5.2	Learning Resource Type	spm=10	Specific kind of learning object. The most dominant kind shall be first.	(NOT USED)	Specific kind of unit of learning.	LOM values + "IMS LD UoL"	Vocabulary	– / R
5.6	Context	spm=10	Principal environment in which the learning and use of this LO is intended to take place.	Principal environment in which the teaching method is intended to be used.	Principal environment in which the unit of learning is intended to be used.	school, higher education, training, other	Vocabulary	O / O
5.7	Typical Age Range	spm=5	Age of typical intended end user.	Use for describing age for **LEARNER CHARACTERISTICS**: Description of the "target group" of this teaching method	Typical age of learners in this unit of learning.		Langstring	R / R
5.9	Typical Learning Time	1	Approximate time it takes to work with or through this LO.	**DURATION**: The estimated amount of time it takes to complete the teaching method when it is being used/implemented	Approximate time it takes to work with or through this unit of learning.		Duration	R / R
5.10	Description	spm=10	Comments on how this learning object is to be used.	**SEQUENCE OF ACTIVITIES**: Detailed description of all activities (including assessment) performed by the	Comments on how this unit of learning is to be used.		Langstring	R / R

				participants as part of the teaching method as well as the activities' temporal sequence.				
5.12	LearningOutcome	spm=30	*LOM EXTENSION*	References and qualifies a learning outcome aimed at by this teaching method.	References and qualifies a learning outcome aimed at by this unit of learning.		(CATEGORY)	R / R
5.12.1	Identifier	1		A globally unique label that identifies the Reusable Learning Outcome (Knowledge, Skill and Competence). The Identifier is sufficient to reference the learning outcome definition in any other system. This element uses same sub-elements as the Identifier element defined in IEEE 1484.12.1-2002 LOM and consists of two sub-elements, Catalog and Entry	A globally unique label that identifies the Reusable Learning Outcome (Knowledge, Skill and Competence). The Identifier is sufficient to reference the learning outcome definition in any other system. This element uses same sub-elements as the Identifier element defined in IEEE 1484.12.1-2002 LOM and consists of two sub-elements, Catalog and Entry		(CONTAINER)	M / M
5.12.2	Title	spm=20		A single mandatory text label for the learning outcome. This is a short human-readable name for the learning outcome. The Title may be repeated in multiple languages. Each translation is represented by an instantiation of Langstring_type. The identifier provides the definitive reference to the learning outcome. The title element provides a convenient, alternative, readable form.	A single mandatory text label for the learning outcome. This is a short human-readable name for the learning outcome. The Title may be repeated in multiple languages. Each translation is represented by an instantiation of Langstring_type. The identifier provides the definitive reference to the learning outcome. The title element provides a convenient, alternative, readable form.		Langstring	M / M
5.12.3	Description	spm=20		A human readable description of the learning outcome. This is an optional unstructured (opaque) "text blob" meant to be interpretable only by humans. The Description may be repeated in multiple languages.	A human readable description of the learning outcome. This is an optional unstructured (opaque) "text blob" meant to be interpretable only by humans. The Description may be repeated in multiple languages.		Langstring	R / R
5.12.4	Type	1		An element that captures the type of learning outcome, according to the	An element that captures the type of learning outcome, according to the	knowledge skill	Vocabulary	R / R

				European Qualification Framework (EQF).	European Qualification Framework (EQF).	competence		
5.12.5	Qualifier	spm=10		A set of metadata elements that capture ranking information about the learning outcomes of learners. This includes proficiency level, weight, interest level, ageing.	A set of metadata elements that capture ranking information about the learning outcomes of learners. This includes proficiency level, weight, interest level, ageing.		(CONTAINER)	R / R
5.12.5.1	Type	1		Capture the genre of the ranking. It can capture the proficiency level of the learning outcome, the learner interest in obtaining the outcome or the ageing of the outcome. Some learning outcomes may degrade by time, like language skills.	Capture the genre of the ranking. It can capture the proficiency level of the learning outcome, the learner interest in obtaining the outcome or the ageing of the outcome. Some learning outcomes may degrade by time, like language skills.	proficiency level, Interest level, weight, ageing	Vocabulary	M / M
5.12.5.2	Value	1		Capture a numeric value for the level. Example the eight EQF levels of proficiency	Capture a numeric value for the level. Example the eight EQF levels of proficiency	(as defined by 5.12.5.3: Scheme)	Charstring	M / M
5.12.5.3	Scheme	1		A reference to the definition or the schema used to describe the qualifier values.	A reference to the definition or the schema used to describe the qualifier values.	URI	Charstring	R / R
5.12.5.4	Description	spm=20		A textual description about the qualifier	A textual description about the qualifier		Langstring	O / O
6	Rights	1	IPR and conditions of use.				(CATEGORY)	R / R
6.3	Description	1	Comments on the conditions of use of this LO.	**LICENSING MODEL**: Information regarding the licensing model of this teaching method description.	Comments on the conditions of use of this unit of learning.		Langstring	R / R
7	Relation	spm=100	Relationship between this LO and other LOs.	Link between this teaching method and other teaching methods/units of learning (use for **EXAMPLE IMPLEMENTATIONS**: References to example implementations of the teaching method, e.g. links to verbal descriptions, IMS LD units of learning)	Links between this unit of learning and the teaching method(s) it implements.		(CATEGORY)	O / O
7.1	Kind	1	Nature of the relationship	Use to link to units of learning ("is implemented in") or other teaching methods.	Use to link to teaching methods that this unit of learning implements.	is implemented in, implements	Vocabulary	M / M
7.2	Resource	1	Target object of this relationship				(CONTAINER)	M / M
7.2.1	Identifier	spm=10	A globally unique label that identifies the target LO				(CONTAINER)	O / O
7.2.1.1	Catalog	1	Name or designator of the	Cataloging scheme of target resource	Cataloging scheme of target resource		Charstring	O / O

			identification or cataloging scheme for this entry. A namespace scheme.					
7.2.1.2	Entry	1	Value or identifier within the catalog. A namespace specific thing.	Entry within catalog	Entry within catalog		Charstring	O / O
7.2.2	Description	spm=10	Description of the target LO	Description of the target resource	Description of the target resource		Langstring	O / O
8	Annotation	spm=30		Use for annotation / comments on: • **TEACHER REFLECTION**, • **STUDENT FEEDBACK**, • **PEER REVIEW**	Use for annotation / comments on: • **TEACHER REFLECTION**, • **STUDENT FEEDBACK**, • **PEER REVIEW**		(CONTAINER)	O / O
8.3	Description	1	Content of this annotation	Content of this comment	Content of this comment		Langstring	M / M
8.4	Type	1	*LOM EXTENSION*	Type of comment	Type of comment	teacher reflection, student feedback, peer review	Vocabulary	M / M
9	Classification	spm=40	Where this LO falls within a particular classification system.	Use to specify • **SUBJECT**, • **GROUP SIZE**, • **SETTING**, • **ASSESSMENT METHOD**, • **LEARNER CHARACTERISTICS**	Use to specify • subject, • group size, • setting, • assessment method, • learner characteristics		(CATEGORY)	R / R
9.1	Purpose	1	Purpose of classifying this LO	Purpose of classifying this teaching method	Purpose of classifying this unit of learning	discipline, prerequisite, skill level, educational level, competency, restrictions, group size (ext.), educational setting (ext.), assessment method (ext.)	Vocabulary	M / M
9.2	Taxon Path		Taxonomic path within a particular classification system	Use depends on 9.1 Purpose: to be used for: • discipline (JACS taxonomy), • assessment (TBD: WP6)	Use depends on 9.1 Purpose: to be used for: • discipline (JACS taxonomy), • assessment (TBD: WP6)		(CONTAINER)	O / O
9.3	Description	1	Description of LO wrt purpose	Description of the teaching method with respect to 9.1:Purpose. Use is mandatory for educational setting (one of: blended, online, distant, f2f)	Description of the teaching method with respect to 9.1:Purpose. Use is mandatory for educational setting (one of: blended, online, distant, f2f)		Langstring	R / R