

# Competence-related Metadata for Educational Resources that Support Lifelong Competence Development Programmes

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## ABSTRACT

In the context of the emerging paradigm of Lifelong Learning, competence-based learning is gradually attracting the attention of the Technology-Enhanced Learning community, since it appears to meet the 21<sup>st</sup> Century learning and training expectations of both individuals and organisations. On the other hand, the paradigm of Learning Objects - as a way to organize, manage, offer and use digital learning resources - retains, to a large extent, its initial anticipations and, supported by Educational Metadata, it is still influencing Technology-Enhanced Learning system design. However, there not exist yet, a commonly accepted proposal for metadata that could describe competence-related characteristics of educational resources that support Lifelong Competence Development Programmes. In this paper we target addressing this issue, that is, we identify and study the main issues related to the competence-relevant characteristics of educational resources, taking into critical consideration the current state-of-the-art information models for competence descriptions (such as IEEE RCD and HR-XML) and we propose an IEEE LOM Competence-based Application Profile that can be used for tagging educational resources in a competence-meaningful manner.

## Keywords

Competence Description, Learning Objects, Educational Metadata

## Introduction

In the context of the emerging paradigm of Lifelong Learning, competence-based education and training is gradually attracting the attention of the Technology-Enhanced Learning community, since it provides important benefits for both individuals and organisations. At the individual's level, a competence-based learning approach may help in identifying and targeting competences that need to be developed in order for an individual to reach certain levels of competences defined by an individual career plan and/or by the human resources department of an organization for a given job description. At the organizations' level, competence-based training bares the potential for designing competence development programmes that targets organisational performance improvement and enhances human resource potential (Hustad, Munkvold & Moll, 2004).

A typical Competence Development lifecycle aims at the continuous enhancement and development of individual and/or organizational competences and consists of the following key steps: (a) the creation of a reference competence description through the identification of required job and task roles together with their associated expected competences and competence levels, (b) the assessment of existing competences at individual or/and organisational level, (c) the gap analysis between existing competences and the required competences for a specific job or task role, (d) the definition of competence development programmes or units of programmes to minimize the identified gaps and (e) the continuous performance monitoring and assessment to confirm improvement (Sinott et al., 2002).

Competence Development Programmes refers not only to Training Programmes that lead to some kind of formal recognition (that is, certificates or degrees), but also to informal learning activities which facilitate competences' acquisition by practice rather than intentional learning (European Commission, 2001; Dodero et al, 2007). Learning Activities are defined as "the explicitly designed or loosely performed activities that are directed at the attainment of an explicit or implicit learning objective" (Koper & Specht, 2007; Prins et al, 2008) and they are supported by appropriate educational resources (typically referred to as learning objects). As a result, the issue of finding, selecting and assembling digital resources which are suitable for the particular learning activities in hand, is a key issue in the learning technologies literature (Ullrich, 2008).

In this context, Learning Objects can be defined as “any digital resource that can be reused to support learning” (Wiley, 2000) and they are typically described with metadata using the IEEE Learning Object Metadata (LOM) (IEEE LOM, 2002), that is, an IEEE standard for the explicit description of educational resources. The IEEE LOM provides an hierarchy of properties for learning resources in nine different categories which include technical, educational and other characteristics. However, the descriptive nature of the IEEE LOM metadata has led to problems with lack of precision in description within the given metadata categories (Sanchez-Alonso & Frosch-Wilke, 2005) which does not facilitate efficient machine-based search and selection of learning resources. Furthermore, IEEE LOM does not include metadata elements that are specifically designed for the description of learning resources in terms of their relevance to Competence Development Programmes. In particular, it does not provide metadata elements that would describe the suitability of a given learning resource for supporting learning activities that are designed to meet competence-based educational objectives within competence development programmes.

This issue has been identified as a potential problem and there are some works that aim to address it, that is, to propose extensions of the IEEE LOM in order to support the description of competence related characteristics of learning resources (Sanchez-Alonso & Sicilia, 2005; Van Assche, 2007; Ng & Hatala, 2007). More specifically, Sanchez-Alonso & Sicilia (2005) proposed an normative metadata description of learning objects aiming to describe their intended use in a given learning context (which includes the description of a specific learner profile) so as to facilitate the acquisition of a certain competence at a given level (Sanchez-Alonso & Sicilia, 2005). Frans Van Assche (2007) proposed to describe learning objects based on their suitability for supporting competence-based educational objectives of national/regional curricula and he described two ontologies for this purpose, one that is based on a revised Bloom’s taxonomy of targeted objectives and one that aims to describe specific subject domains (Van Assche, 2007). Ng & Hatala (2007) proposed an ontology-based modeling of competences representing their definition, knowledge reference, evidence and level of proficiency, and they propose to use it for tagging learning resources in regard to their competence-based objectives. These proposals typically exploit the IEEE LOM element [9.1 Classification.Purpose], however, they do not take into consideration the current state-of-the-art in competence description modeling through the specifications proposed by international working groups such as IMS (IMS RDCEO, 2002), IEEE (IEEE RCD, 2004) and HR-XML (HR-XML, 2006).

In this paper we target addressing this problem, that is, to identify and study the main issues related to the competence-relevant characteristics of learning resources taking into consideration a critical view on competence modeling as expressed in the current state-of-the-art information models for competence descriptions, and propose an IEEE LOM Competence-based Application Profile that can be used for tagging educational resources in a competence-meaningful manner. The paper is organized as follows. Following this introduction, Section 2 presents the concept of competence, identifies the key dimensions of competence, and studies the current initiatives on modeling competencies. Section 3 describes the proposed approach for defining an application profile of the IEEE LOM standard (IEEE LOM, 2002) and Section 4 presents the proposed competence-based application profile of IEEE LOM standard produced as a result of the above described process. Finally, we present a full example from a real life case study (namely, the e-Access2Learn Project) to demonstrate and validate our proposal, and discuss our conclusions and ideas for future work in this field.

## **Theoretical background: Competence Definitions and Models for Describing Competences**

Today, competences are proved to be a critical tool in human resource management, vocational training and performance management. However, despite the fact that competences are an important tool for various fields of application, the research community has not agreed to a commonly accepted definition of the term resulting to multiple interpretations (Boon & van der Klink, 2002; Delamare & Winterton, 2005; Sampson & Fytros, 2008a). The competence concept was originally developed in Psychology referring to the individual’s ability to respond to certain demands placed on them by their environment. Sampson & Fytros (2008) provided a review of the main definitions of competence in literature of different application fields, in an effort to provide a thorough understanding of the different aspects that this term involves, and they presented examples of competence definitions in the field of human resource management and in the field of vocational training and education (Sampson & Fytros, 2008a). Based on the analysis of the different competence definitions presented, three core dimensions of the term “competence” were identified, namely, (a) the individual’s characteristics, which refer to a set of characteristics such as knowledge, skills, attitudes, abilities, behaviors, traits, values, motives, self-concepts, aspects of one’s self-image, social role and/or self-control; (b) the individual’s competence proficiency level, which are used to classify

competences at specific levels, according to the performance of the individual when demonstrating the competence by an action; (c) the context in which the individual's competence is applied, which may refer to a specific area of a job, to an occupation or function, to a life outcome, to work-related situations, to a specific situation, or to a specific task (Sampson & Fytros, 2008a). In this paper, we adopt the generic definition of the term "competence" given in (Sampson & Fytros, 2008a): a competence can be defined as a set of personal characteristics (e.g. skills, knowledge, attitudes) that an individual possess or needs to acquire, in order to perform an activity within a specific context, whereas performance may range from the basic level of proficiency to the highest levels of excellence.

Competencies need to be formally modeled so as to be able to interchange competencies description between systems. To this end, international specifications for competence description, such as the IMS RDCEO (Reusable Definition of Competency or Educational Objective) (IMS RDCEO, 2002), the IEEE RCD (Reusable Competency Definitions) (IEEE RCD, 2004) and the HR-XML Competencies (Measurable Characteristics) (HR-XML, 2006), have been recently proposed.

Mapping the elements of IMS RDCEO to those of the HR-XML specifications indicates that both specifications provide: (a) identification of the competence, (b) title of the competence, (c) description of the competence, (d) definition of the competence, (e) taxonomy of the competence, (f) personal information, while HR-XML adds elements for measurable evidence and measurable weights and importance levels (Sampson, Karampiperis & Fytros, 2007).

A careful examination of these specifications reveals that they do not included in their scope important dimensions of the generic competence model. Thus, based on the key dimensions of competence, Sampson, Karampiperis & Fytros (2007) have identified the following issues:

- a) The notion of competency itself is not detailed. However, competence modeling should anticipate including all the facets of the dimension "personal characteristics", namely knowledge, skills, and attitudes. As a result, at least one further level of detail could be useful in the existing schemas for describing competences.
- b) Measurement scales that represent proficiency levels can be both qualitative and quantitative. Although expecting to use a single, unified measurement scale is not realistic, it would be desirable that at least the values of these scales must be represented in an ordered list, as part of the competence definition schema.
- c) The existing approaches to modeling competencies exclude context from their schemas. However, "context" is an important dimension related to competence definition and it should be captured in the competence description (Prins et al, 2008).

At this point, it should be noted that these issues cannot be considered as a list of flaws for HR-XML or IMS RDCEO, since these specifications clearly declare that these areas are outside of their scope.

## **Methodology for defining an IEEE LOM Competence-related Application Profile**

As already discussed, educational resources are typically described with metadata using the IEEE Learning Object Metadata (LOM), this does not include metadata elements that are specifically designed for the description of learning resources in terms of their relevance to Competence Development Programmes. In particular, it does not provide metadata elements that would describe the suitability of a given learning resource for supporting learning activities that are designed to meet competence-based educational objectives within competence development programmes.

To this end, we propose to build an IEEE LOM Competence-based Application Profile that can be used for tagging educational resources in a competence-meaningful manner. Hence, based on the key dimensions of competence and the formally defined competence specification models and taking into consideration the CEN/ISSS Learning Technologies Workshop (LTW) guidelines for building application profiles in e-learning (Smith, Van Coillie & Duval, 2006), we can identify possible extensions to the IEEE LOM standard to accommodate competence-related properties.

The process of deriving competence-related metadata consists of the following key steps:

*Step 1: Identify the main dimensions of the concept of competence.* This step aims at identifying and analyzing the various dimensions of the concept competence. The output of this step is detailed in Sampson & Fytros (2008a).

*Step 2: Study existing competence description information models.* This step aims at analysing the competence description models proposed by international working groups such as IEEE-RCD and HR-XML. The output of this step is the mapping between the elements of the underlying models of these specifications and the identification of aspects that are important for competence modeling taking into consideration the competence dimensions identified in step 1. Details on this matter are given in (Sampson, Karamperis & Fytros, 2007).

*Step 3: Identify the competence relevant characteristics of learning resources.* This step is based on the finding of step 2 and it aims to create a schematic representation of competence relevant characteristics for learning resources that will guide our effort to identify possible extensions to the IEEE LOM elements concerning competence related information.

*Step 4: Identify suitable IEEE LOM element for accommodating the competence related information.* This step examine all the categories and elements of IEEE LOM, in order to find available metadata items that can host the competence relevant characteristics of learning resources.

*Step 5: Extending value space or datatype.* This step includes the identification of possible extensions required in the value space or datatype of the competence related IEEE LOM elements.

*Step 6: Add new sub-elements to the related IEEE LOM element.* This step adds new elements and sub-elements to the IEEE LOM existing ones with special attention for avoiding semantic overlaps with other existing elements.

## Proposed IEEE LOM Competence-related Application Profile

In this section, we propose an IEEE LOM Competence-related Application Profile that can be used for tagging educational resources in a competence-meaningful manner. To this end, a schematic representation of competence relevant characteristics for learning resources is created to guide our effort for identifying extensions to the IEEE LOM elements concerning competence related information (as described in Step 3). More specifically, the main elements of the schematic representation are as follows:

- **Title:** A short name for the competence that the particular learning object targets at.
- **Description:** A narrative description of the competence that the particular learning object targets at.
- **ProficiencyLevel:** The proficiency level of the competence that the particular learning object targets at. The proficiency level may include a short name and a narrative description. It may also include different types of proficiency level based on the facets of the dimension “personal characteristics” of the term competence, such as “Knowledge”, “Skill” and “Attitude”. Moreover different scales may be used in order to represent proficiency levels. The values of these scales must be represented as an ordered list.
- **Context:** The context of use in which the competence that the learning object targets is referred to.

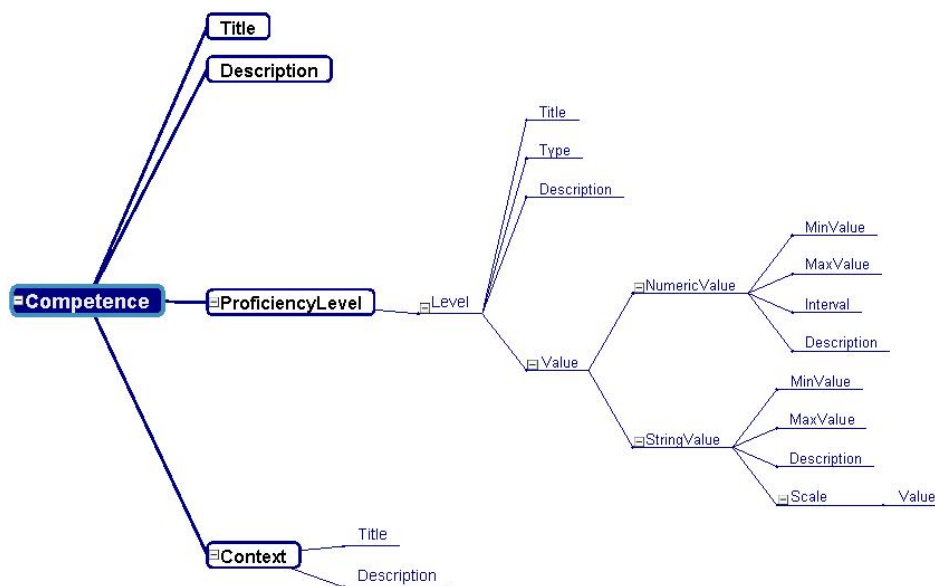


Figure 1: Competence characteristics relevant to learning resources

The next step (Step 4) is the identification of these elements of IEEE LOM which are considered to be suitable for accommodating competence related information. To this end, we have identified that the IEEE LOM categories which are most related with competence properties of learning resources are: the [5.Educational] Category through the [5.8 Educational.Difficulty] element and the [9.Classification] Category through the [9.1 Classification.Purpose] element.

The introduced extensions to the IEEE LOM information model are presented in a tabular form for each identified IEEE LOM category. More specifically:

The IEEE LOM [9.Classification] category describes a learning object in relation to a particular classification system (IEEE LOM, 2002). In element [9.1 Classification.Purpose] we can use the “competence” value to state that the purpose of using this particular learning object is to support the attainment of a particular competence. This element already contains a specific vocabulary (for example: prerequisite, accessibility, etc.) that must be updated with the “competence” value for the purpose of (as shown in Table 1).

Table 1: Extensions of IEEE LOM [9.1 Classification.Purpose] element

| Nr  | Name           | Explanation  | Size                                 | Order       | Value Space  | Datatype           | Example               |
|-----|----------------|--|--------------------------------------|-------------|--|--------------------|-----------------------|
| 9   | Classification | This category describes where this learning object falls within a particular classification system | smallest permitted maximum: 40 items | Unordered   |  |                    |                       |
| 9.1 | Purpose        | The purpose of classifying this learning object  |                                      | Unspecified | accessibility<br>Prerequisite<br>...<br>competence | Vocabulary (State) | Example: "competence" |

The IEEE LOM element [5.8 Educational.Difficulty] describes how difficult it is to work with or through this learning object (IEEE LOM, 2002). In our proposal, this element can be used for the representation of the competence proficiency level that this learning object addresses. However, in accordance to the competence characteristics related to the proficiency level presented in Figure 1, extensions to this element are needed in order to include sub-elements that can describe the values and the scales of a particular competence proficiency level (as shown in Table 2).

Table 2: Extensions of IEEE LOM [5.8 Educational.Difficulty] element

| Nr      | Name       | Explanation  | Size | Order       | Value Space | Datatype  | Example           |
|---------|------------|--|------|-------------|-------------|---|-------------------|
| 5.8     | Difficulty | The competence proficiency level that this learning object addresses | 1    | Unspecified |             |   |                   |
| 5.8.1   | Level      | There may be multiple instances of this category                     | 3    | Unspecified |             |   |                   |
| 5.8.1.1 | Title      | Text label of the proficiency level                                  | 1    | Unspecified |             | LangString (smallest permitted maximum 1000 char) | Example: "Novice" |
| 5.8.1.2 | Type       | The type of  | 1    | Unspecified | Knowledge   | Vocabulary  | Example:          |

|             |              | the proficiency level                                       |   |             | Skill Attitude | (Enumerated)                                      | "Skill"  |
|-------------|--------------|---|---|-------------|----------------|---|--|
| 5.8.1.3     | Description  | A human-readable description of the proficiency level       | 1 | Unspecified |                | LangString (smallest permitted maximum 1000 char) | Example: "Adequately performing of the targeted competence"                        |
| 5.8.1.4     | Value        | Rating values for this competence proficiency level         | 1 | Unspecified |                |   |  |
| 5.8.1.4.1   | NumericValue | NumericValue is the location for quantitative rating scales | 1 | Unspecified |                |   |  |
| 5.8.1.4.1.1 | MinValue     | The minimum value of the rating scale                       | 1 | Unspecified |                | Double (in the range 1 to 100)                    | Example: "1"   |
| 5.8.1.4.1.2 | MaxValue     | The maximum value of the rating scale                       | 1 | Unspecified |                | Double (in the range 1 to 100)                    | Example: "10"  |
| 5.8.1.4.1.3 | Interval     | The increment or step for the relevant scale                | 1 | Unspecified |                | Double (in the range 1 to 100)                    | Example: "1"   |
| 5.8.1.4.1.4 | Description  | A human-readable description of the rating scale            | 1 | Unspecified |                | LangString (smallest permitted maximum 1000 char) | Example: "A ten level scale for English language competence"                       |
| 5.8.1.4.2   | StringValue  | StringValue is the location for qualitative rating scales   | 1 | Unspecified |                |   |  |
| 5.8.1.4.2.1 | MinValue     | The minimum value of the rating scale                       | 1 | Unspecified |                | LangString (smallest permitted maximum 1000 char) | Example: "All"   |
| 5.8.1.4.2.2 | MaxValue     | The maximum value of the rating scale                       | 1 | Unspecified |                | LangString (smallest permitted maximum 1000 char) | Example: "C2"  |
| 5.8.1.4.2.3 | Description  | A human-readable description of the rating scale            | 1 | Unspecified |                | LangString (smallest permitted maximum 1000 char) | Example: "A six level scale for Spanish language competence according to Europass" |
| 5.8.1.4.2.4 | Scale        | The scale that is used in order to represent                | 1 | Unspecified |                |   |  |

|               |       |  |   |             |  |   |   |
|---------------|-------|--|---|-------------|--|---|---|
|               |       | proficiency levels                             |   |             |  |   |   |
| 5.8.1.4.2.4.1 | Value | An ordered list within the values of the scale | n | Unspecified |  | LangString (smallest permitted maximum 1000 char) | Example: "Novice", "Advanced", "Proficient" |

Finally we introduce the addition of a new category with special attention to avoiding semantic overlaps with other existing elements of the information model, namely [10.Competence] category that consists of three main elements namely [10.1 Competence.Title] Element, [10.2 Competence.Description] element and [10.3 Competence.Context] element (as shown in Table 3).

Table 3: Extensions of IEEE LOM new [10. Competence] category

| Nr     | Name        | Explanation   | Size | Order       | Value Space | Datatype  | Example  |
|--------|-------------|---|------|-------------|-------------|---|--|
| 10     | Competence  | This category specifies the competence description                                | 1    | Unspecified |             |   |  |
| 10.1   | Title       | Text label of the competence that the learning object targets                     | 1    | Unspecified |             | LangString (smallest permitted maximum 1000 char) | Example: "Problem Solving"   |
| 10.2   | Description | A human-readable description of the competence that the learning object targets   | 1    | Unspecified |             | LangString (smallest permitted maximum 1000 char) | Example: "Identifying problems and implement solutions"                                    |
| 10.3   | Context     | The context in which the competence that the learning object addresses is applied | 1    | Unspecified |             |   |  |
| 10.3.1 | Title       | Text label of the context   | 1    | Unspecified |             | LangString (smallest permitted maximum 1000 char) | Example: "Kick-off Meeting"  |
| 10.3.2 | Description | A human-readable description of the context                                       | 1    | Unspecified |             | LangString (smallest permitted maximum 1000 char) | Example: "The first meeting with the project team to discuss the role of each team member" |

### Case Study: Using the proposed IEEE LOM Competence-related Application Profile in a real life project

We now present a full example from a real life case study (namely, the e-Access2Learn Project) to demonstrate and validate our proposal. The e-Access2Learn project (<http://www.eaccess2learn.eu>) aims to provide tools and services for the development and sharing of accessible eTraining Resources, Activities and Courses that bare the potential to be inter-exchanged between eTraining Platforms and Programmes.

The e-Training Activities and Courses stored to the e-Access2Learn Repository have been tagged with educational metadata following the proposed IEEE LOM Competence-related Application Profile. Therefore, the searching mechanism of the repository, as presented in Figure 2, provide the users the capability to search for e-Training Courses with competence-related searching criteria. More precisely, in Figure 2 we are searching the e-Access2Learn Repository for e-Training Courses, which target the Competence named: “Business Presentation” at the proficiency level of “Novice”. As presented to Figure 3, the repository returned to the user one (1) e-Training Course that matches the searching criteria

The screenshot shows the e-Access2Learn search interface. At the top, there is a banner with the logo "Access II" and the text "SUPPORTING VOCATIONAL EDUCATION AND TRAINING OF DISADVANTAGED USER COMMUNITIES". To the right, there are logos for the European Union and the Education and Culture DG Lifelong Learning Programme.

Below the banner, the text "Centre for Research and Technology Hellas (e-Content Supplier, e-Courses Supplier, e-Training Provider)" is displayed. The main content area is titled "Search e-Training Courses" and contains an "Advanced Search" form. The form includes the following fields:

- Title: enter title
- Language: [dropdown menu]
- Description: enter description
- Key-Words: enter key-words
- Subject: [dropdown menu]
- Typical Age Range: [dropdown menu]
- End User Role: Motor Disabled People
- Competence Title: Business Presentation
- Proficiency Level: Novice

At the bottom of the form, there are "Search" and "Clear form" buttons. To the left of the search form is a "Main Menu" with links to Home Page, Edit Profile, About eAccess II, Users' Community, Services and Tools, Repository, Press Room, and Announcements. Below the menu are two accessibility icons: W3C HTML 4.01 and W3C WAI-A WCAG 1.0.

At the bottom of the page, there is a disclaimer: "Developed and Maintained by the Advanced e-Services for the Knowledge Society Research Unit, ITI, CERTH".

Figure 2: e-Access2Learn searching mechanism with competence-related searching criteria

The screenshot shows the e-Access2Learn search results page. At the top, there is a banner with the logo "Access II" and the text "SUPPORTING VOCATIONAL EDUCATION AND TRAINING OF DISADVANTAGED USER COMMUNITIES". To the right, there are logos for the European Union and the Education and Culture DG Lifelong Learning Programme.

Below the banner, the text "Centre for Research and Technology Hellas (e-Content Supplier, e-Courses Supplier, e-Training Provider)" is displayed. The main content area is titled "e-Training Courses: Search Results" and contains the following information:

Search has Returned 1 e-Training Courses

| Business Presentation         |   | ☆☆☆☆    |
|-------------------------------|---|---------|
| Description:                  | Presentations play a primary role in business. This course introduces the Business Presentation concept |         |
| Date Added:                   | 29/07/2008  |         |
| Statistics                    |   |         |
| Metadata Previewed:           | 1 times   |         |
| e-Training Course Downloaded: | 1 times   |         |
| Metadata File Download        | File Download   | Comment |

At the bottom of the page, there is a disclaimer: "Developed and Maintained by the Advanced e-Services for the Knowledge Society Research Unit, ITI, CERTH".

Figure 3: Search Results of e-Training Courses based on the above searching criteria

Centre for Research and Technology Hellas (e-Content Supplier, e-Courses Supplier, e-Training Provider)

| Main Menu                                   |  |
|---|--|
| <a href="#">Home Page</a>                   |  |
| <a href="#">Edit Profile</a>                |  |
| <a href="#">About eAccess II &gt;&gt;</a>   |  |
| <a href="#">Users' Community &gt;&gt;</a>   |  |
| <a href="#">Services and Tools &gt;&gt;</a> |  |
| <a href="#">Repository &gt;&gt;</a>         |  |
| <a href="#">Press Room &gt;&gt;</a>         |  |
| <a href="#">Announcements</a>               |  |

### e-Training Course Metadata

| General                        |   |   |
|--------------------------------|---|---|
| <b>Title:</b>                  | Business Presentation   |   |
| <b>Language:</b>               | English   |   |
| <b>Description:</b>            | Presentations play a primary role in business. This course introduces the Business Presentation concept     |   |
| <b>Key Words:</b>              | Business Presentation<br>Business English   |   |
| <b>URL:</b>                    | Business Presentation MD.zip  |   |
| Life Cycle                     |   |   |
| <b>Status:</b>                 | final   |   |
| <b>author:</b>                 | CERTH (20-07-2008)  |   |
| <b>publisher:</b>              | CERTH (20-07-2008)  |   |
| Meta-Metadata                  |   |   |
| <b>creator:</b>                | CERTH (20-07-2008)  |   |
| <b>validator:</b>              | CERTH (20-07-2008)  |   |
| Technical                      |   |   |
| <b>Format:</b>                 | application/zip   |   |
| <b>Size:</b>                   | From 250KB to 500KB   |   |
| Rights                         |   |   |
| <b>Cost:</b>                   | no  |   |
| <b>Copyrights:</b>             | yes   |   |
| Educational                    |   |   |
| <b>Interactivity Level:</b>    | low   |   |
| <b>Interactivity Type:</b>     | mixed   |   |
| <b>Learning Resource Type:</b> | Training Course   |   |
| <b>Intended End User Role:</b> | Motor Disabled People   |   |
| <b>Educational Context:</b>    | Vocational Training   |   |
| <b>Typical Age Range:</b>      | Initial Vocational Training   |   |
| <b>Difficulty:</b>             | easy  |   |
| <b>Typical Learning Time:</b>  | 1 didactic hour   |   |
| Classification                 |   |   |
| <b>Source:</b>                 | NACE  |   |
| <b>Subject:</b>                | M.80 - Education  |   |
| Accessibility                  |   |   |
| <b>Description:</b>            | Has Visual  | no  |
|                                | Has Auditory  | no  |
|                                | Has Text  | yes   |
|                                | Has Tactile   | no  |
| <b>Color Avoidance:</b>        | Uses Stylesheets  | yes   |
|                                | Avoid Red   | no  |
|                                | Avoid Red-Green   | no  |
|                                | Avoid Blue-Yellow   | no  |
|                                | Avoid Green-Yellow  | yes   |
|                                | Avoid Orange  | yes   |
|                                | Avoid Red-Black   | yes   |
| Avoid Purple-Gray              | yes   |   |
| <b>Visual Properties:</b>      | Maximum Contrast  | 90  |
|                                | Minimum Brightness  | 45  |
|                                | Maximum Brightness  | 100   |
| Competence                     |   |   |
| <b>Title:</b>                  | Business Presentation   |   |
| <b>Description:</b>            | Business Presentation is the act of speaking to an audience about business ideas, propositions or decisions |   |
| <b>Proficiency Level:</b>      | <b>Type:</b>  | Attitude  |
|                                | <b>Title:</b>   | Novice  |
| <b>Proficiency Level:</b>      | <b>Description:</b>   | Adoption of the appropriate techniques in order to make a business presentation and appreciation of the importance of presentations in business process |
|                                | <b>Type:</b>  | Knowledge   |
| <b>Proficiency Level:</b>      | <b>Title:</b>   | Novice  |
|                                | <b>Description:</b>   | Knowledge about the basic phrases and the appropriate vocabulary that is used in business presentation situations                                       |
| <b>Proficiency Level:</b>      | <b>Type:</b>  | Skill   |
|                                | <b>Title:</b>   | Novice  |
| <b>Description:</b>            | Be able to make a business presentation with comfort and effectiveness                                      |   |

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Figure 4: e-Training Course Metadata Record Preview

In Figure 4 the full metadata record of the selected e-Training Course is presented. The section “Competence” provides to the user detailed description about the Competence that this particular e-Training Course targets at.

Within this framework, the particular instance of the eAccess2Learn IEEE LOM Competence-related Application Profile was validated by a Controlled Method through Replicated Experiment, that is, several instances of the subject (the identified end users of the IEEE LOM AP) performed a number of tasks related with the use of the proposed AP and compared its potential in describing Digital Resources in response to Competence-based Educational Objectives as opposed to the original IEEE LOM Sceama. The results of this experiment provided solid indications that the proposed IEEE LOM AP provided the means for tagging educational resource in a competence-meaningful manner

## Conclusions

In lifelong learning, education and training based on attaining competence-based educational objectives appears to become mainstream approach. Within this context, Technology-supported Competence Development Programmes bare the potential of integrating training on-demand in real life work environments and beyond that, they may support the individual lifelong learners in making informed decisions about their continuous personal development during various periods of their lives. The design of Competence Development Programmes assume the clear definition of educational objectives in terms of targeted competences (both type and level), the design of learning activities that are appropriate for the attainment of the defined competences, the efficient selection of suitable educational resources that can implement the learning activities, the accurate definition of the educational setting (tools, delivery means, etc) and the construction of assessment activities that can measure individuals' current status of the competence level.

Within this framework, the selection of appropriate educational resources based on an accurate and informed estimation of their suitability in accordance to (a) the type of the learning activity to be supported, (b) the educational objectives expressed in terms of competence types and levels, (c) the given educational setting conditions (that is, available tools, delivery means, the presence and roles of tutors and/or other learners), and (d) the individual learner profile (including his/her status of competence). Today, the World Wide Web offers an enormous amount of available resource with potential educational value, both resources that are deliberately designed for support meeting certain educational objective (typically, organised through repositories of learning material), and resources which are produced as the result of real life formal and informal tasks.

Thus, the issue of finding, selecting and assembling digital resources which are suitable for facilitating the attainment of the certain targeted competences is a key issue in technology-supported competence-based lifelong learning. In this paper it was argued that an IEEE LOM Competence Application Profile is needed for tagging educational resources in a competence-meaningful manner for facilitating people and organisations in their search, retrieve, (re)-use and share of appropriate educational resources for Competence Development Programmes. Thus, following the CEN/ISSS LTW guidelines for building application profiles, we presented our proposal for an IEEE LOM Competence Application Profile, based on the competence dimensions identified in our previous work (Sampson & Fytros, 2008a) and the existing competency specification models (IMS RDCEO, HR-XML).

Finally, it would be worthy to mention that the work reported in the paper could be further exploited in facilitating the automatic selection and sequencing of educational resources in a competence-related meaningful manner towards the development of adaptive and personalised learning paths based on competence-related educational objectives. Initial work towards this direction was reported in (Karampiperis & Sampson, 2006) and it could improved by incorporating competence-related characteristics in the description of the learning resources as proposed in this paper.

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