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Creating Life-Long Learning Scenarios in Virtual Worlds

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1. Introduction

Virtual worlds, such as Second Life, were considered an emerging technology surrounded by hype and growing educational expectations. These immersive world applications have the potential to support multimodal (using different senses) communications between learners; they set up the potential for problem – or challenge-based learning and offer the learner control through exploratory learning experiences (Saunders, 2007). In the recent Metaverse Roadmap Report 2007, Smart et al. (2007) envisage a powerful scenario over the next 20 years when:

> "[virtual worlds] may become primary tools (with video and text secondary) for learning many aspects of history, for acquiring new skills, for job assessment, and for many of our most cost-effective and productive forms of collaboration. (Smart et al., 2007: 7)"

However despite this, much needs to be understood about how to best convert these spaces for learning purposes such as seminars, simulations, modelling, learning activities, networked learning experiences, cybercampuses and streamed lectures (Prasolova-Førland et al., 2006). Otherwise, virtual worlds might be the next misused educational technology. Many educational technologists would agree that poor utilization of the features of a technology will enviably lead to complacency with that technology and probably lead to it being either being abandoned, or worse, massively underutilized (Rappe et. al, 2008). Derived from these statements, the purpose of this chapter is to describe the integration of metadata into Second Life to foster the growth of digital learning spaces.

In an effort to assist European practitioners (individuals as well as the existing communities) that work in the field of education and training educators and are genuinely interested in using Second Life within a Lifelong learning perspective the LLL3D (Life-long Learning in Three Dimensions) project team is promoting opportunities for teachers, trainers, researchers to discover, learn about and utilise different "learning scenarios" for virtual worlds. The learning scenario approach provides access to best practice case studies across formal, non-formal and informal levels and different sectoral activities. The LLL3D project is contributing to the establishment of a European research and practice area in Lifelong Learning, paying attention to the promotion of general awareness of the potential of MUVEs, dissemination and to increasing the acceptance of MUVEs (Multi-user Virtual Environments) as a highly promising cutting-edge technology for online learning. In the framework of the LLL3D project, the working group of different partners have created a set of services and tools in order to provide guidance to all practitioners who are interested in exploring the potential of Second Life for educational purposes, and learning how to use this environment. One of the essential aspects of the project was to integrate a metadata scheme into a grid that supplies researchers and practitioners with a system of existing and possible successful approaches to using MUVEs in learning and teaching. It is our desire that the examination of this project highlights the increasingly recognised importance of structured metadata for the development of learning scenarios and the transferability of this approach to other educational domains and eventually illustrate the possibilities, encourage you and spark ideas of your own.

After providing a general overview of case-based learning, this chapter proceeds with a metadata scheme that can be used for the integration of learning scenarios into MUVE s(Multi-user Virtual Envrionments) such as Second Life (SL). Although not all of the observations are positive on their own, pinning down the details of which educationally significant characteristics pertain to which entities in learning scenarios and which relationships are important is a crucial step in understanding what information is needed to create resource descriptions that meet educational requirements, and how to go about gathering that information.

2. Main definitions

A useful definition of metadata is that used by NISO (2004) "structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource". This definition has two important parts. Firstly, it distinguishes metadata from unstructured textual descriptions of a resource. The structuring of metadata normally takes the form of elements with defined semantics to describe specified characteristics of a resource so that machine processing of the information can ocur without a need for computational semantic analysis techniques such as text mining. Secondly, the NISO definition stresses that metadata exists to facilitate a range of activities. Resource discovery is the most visible activity facilitated by metadata, and is the one that seems most closely associated with metadata by most people; however, appropriate management and use of resources are no less important.

Defining what we mean by learning scenarios is more difficult. However, we think that "anything used for teaching and learning" captures the essence of what we are interested in. At this stage, an example for a learning scenario would be “all learning settings that use collaborative learning for learning a language with adult learners only in-world”. This scenario would contain all the real cases that could be found in any MUVE and also those that are only imaginable. Our learning scenario grid consists of 4 dimensions (learning/teaching approaches, discipline/subject, target audience, type of interaction) with 20 sub-values. This grid should not be developed mainly by theoretical considerations but by empirical work, by collecting concrete examples of the classes of learning activities (e.g. an example/practice case for a face-to-face learning approach for language learning).

The following sections will focus on one of the main established metadata standard most relevant to learning scenarios, the IEEE LOM (Learning Object Metadata), and will briefly describe and reflect on its characteristics and applications. This paper will also outline the current work being undertaken on this schema. Finally we look at some of the future challenges facing the field of metadata for learning scenarious regardless of which specific standard one favours.

3. An overview of case-based learning

New standards and specification are more oriented towards describing learning scenarios than just contents. These specifications try to describe all the aspects and the elements more related to the learning process in itself, such as role playing, that is, the second level of description as aforementioned. It seems clear that all this this information needs to be stored in a higher semantic level. Although the metadata schemes may seem too complex for learning scenarios, their flexibility and multilevel description capabilities allow the specification of any learning process ranking from simple educational itineraries to complex processes including collaborative working capabilities. Nevertheless, these metadata schemes lack from a formal description for some of the definitions required for developing learning scenarios in virtual worlds.

Each case in the LLL3D is designed as one or more learning situations trying to reproduce real professional situations where students in one field need to apply practical knowledge for solving a problem, in a virtual world environment. This methodology, which tries to ensure a high quality of the learning process, takes into account all the learning activities that are designed with all the learning goals in mind, in the following structure:

Learning situations

Competences

Learning goals

Activities

Resources

This structure is also partially supported by a case study template with the description of the subject, which is human-readable, but non machine readable. Each case study template has been designed on the basis of the following premises:

- A sound formulation of competences and learning goals;
- Learning activities which are coherent with the competencies to be developed

Within the context of the LLL3D project, we define case-based learning (CBL) as an instructional strategy that uses case study as a resource and the case method as the learning scenario description where learners and instructor interact. The case study template is a descriptive document based on a real situation or event. The case tries to facilitate a balanced relationship between the multidimensional representation of the context, its participants and the the reality of the situation. A case can be used to generate different case studies from a subset of case patterns and a collection of learning resources, following an instructional design approach. Therefore, at the bottom level, we need formal representations for case-based learning scenarios, which involve all the elements in the learning process (learners, activities, competences, resources, etc.) (Barker et al, 2006). The goal is to provide a mechanism for scenario design for learning in virtual worlds according to learner preferences and already acquired competencies and learning goals given by teachers (Barker et al, 2006, Duval et al, 2002). It is necessary to adapt the particular needs of the virtual learning scenario to the specifications available where competencies are used to describe goals and outcomes of learning activities (Barker et al, 2006). In this sense, there is a lack of standards for describing competencies at a rich semantic level because major metadata schemes such as IEEE LOM are not enough to represent all these relationships identified previously.

4. IEEE Learning Object Metadata (LOM)

The IEEE LOM is (currently) an open and internationally recognized two-part standard for the description of "learning objects" and is composed of a conceptual data schema (IEEE, 2002) and an XML binding of that schema (IEEE, 2005). The definition of "learning object" used in the standard is "any entity digital or non-digital that may be used for learning, education, or training", which is comparable to the working definition used above. The LOM data schema specifies which characteristics of a learning object should be described and what vocabularies may be used for these descriptions; it also defines how this data model can be amended by additions or constraints.

The LOM conceptual data schema consists of a hierarchy of elements as shown in figure 1. The first level is composed of nine categories, each of which contains sub-elements; these subelements may be simple elements that contain data, or they may themselves be aggregate elements that contain further sub-elements.

The semantics of LOM elements are determined by their context: they are affected by the parent or container element in the hierarchy and sometimes by other elements in the same container. For example the various description elements (1.4, 5.10, 6.3, 7.2.2, 8.3 and 9.3) each derive their meaning from their parent element: e.g. 5.10, education.description describes educational characteristics of the resource; 6.3 rights.description relates to the terms and conditions of use of the resource, and so on. In addition, description element 9.3 also derives some of its meaning from the value of element 9.1 purpose in the same instance of the classification category element. The data schema also specifies the value space and datatype for each of the simple data elements. The value space defines the restrictions, if any, on the data that can be entered for that element.

For some elements the value space allows any string of Unicode characters to be entered; for other elements entries must be drawn from a declared list (i.e. a controlled vocabulary) or must be in a specified format (e.g. date and language codes). Some element datatypes simply allow a single string of characters to be entered; others comprise two parts as described below:

LangString datatype: where the data entered is likely to be text that would be read directly by a human the data is of a type defined by the LOM as a LangString. LangString items comprise two parts: one providing a language code and the second the Unicode text in the language specified by the code. The same information may be conveyed in multiple languages by repetition of data within an element as several LangStrings.

Vocabulary datatype: where the LOM data schema requires an element to be described by a controlled vocabulary the element will be of the vocabulary datatype. Such elements are composed of Source-Value pairs; the source should contain the name of the list of terms being used and the value should contain the chosen term.

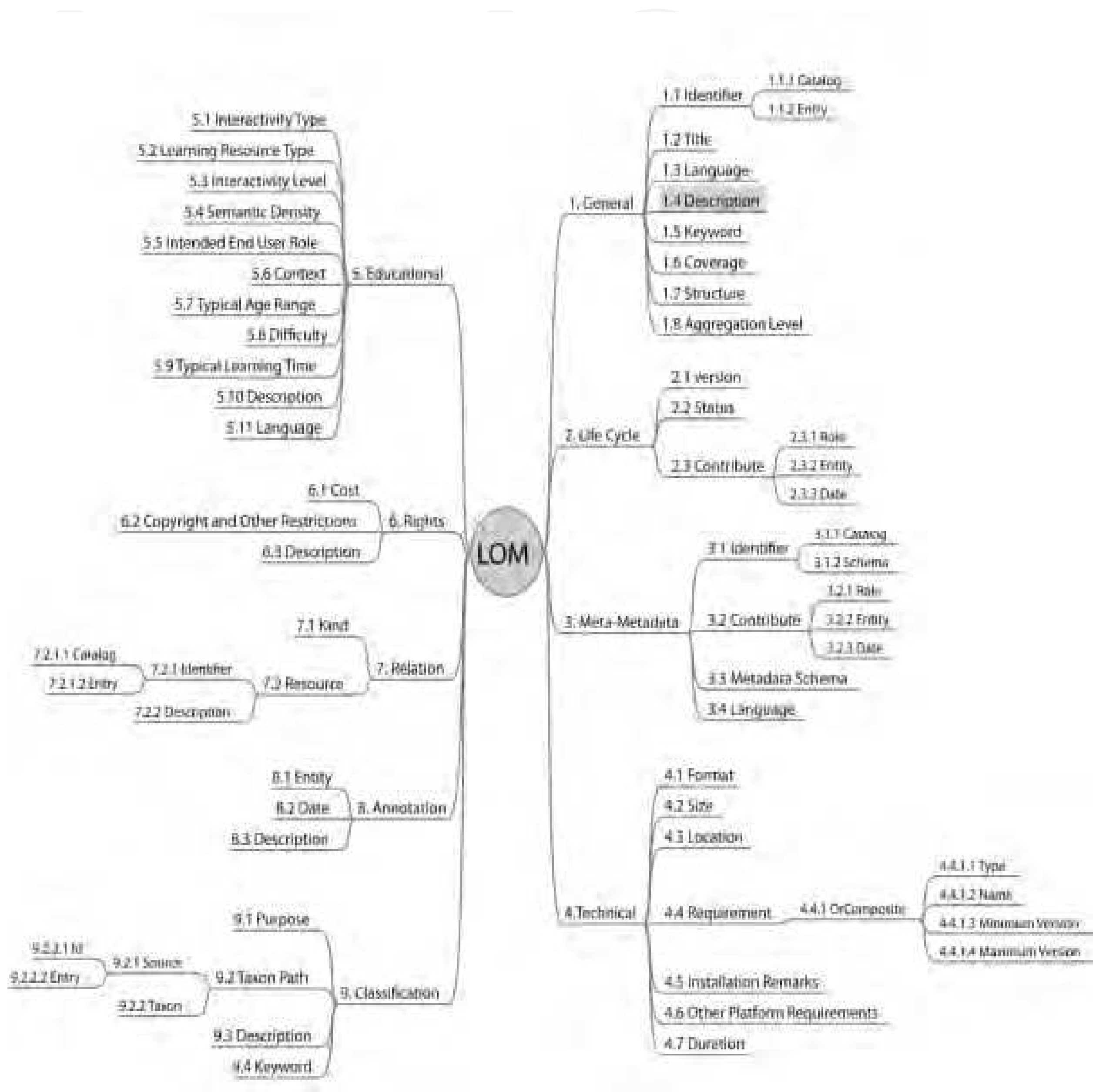

Fig. 1. A schematic representation of the hierarchy of elements in the LOM data model.

DateTime and Duration datatypes: these datatypes allow a date or period of time to be given in a machine-readable format (the value space is based on the ISO 8601:2000 standard; an example of a correctly formatted date is 2003-11-22); a human-readable description may be provided instead of or in addition to the formatted date (e.g. "late 20th century").

While implementing the LOM for the development of our learning scenarios we did not select all the elements in the conceptual data schema. The creation of of our own customized metadata schemes based on LOM allowed us to specify which elements and vocabularies we will be using mostly. While we discarded some elements from the LOM we also supplemented some of the LOM vocabularies with values that are appropriate to the teaching and learning community that we wish to support.

The LOM has been widely implemented by repositories and other learning resource providers, partly as a result of its status as an international standard, and partly through its association with other influential specifications, such as those produced by the IMS Global Learning and by ADL (SCORM)(no date). Examples of repositories and initiatives that have adopted the LOM are the JORUM (no date), a JISC funded repository of teaching and learning materials for UK Further and Higher Education; the European Ariadne foundation (Ariadne, no date); various European SchoolNet projects (European SchoolNet, no date); the Global Learning Objects Brokered Exchange (GLOBE, no date) federation; and many more.

5. The LLL3D metadata scheme

While the influence of the LOM has been considerable in terms of the development of our learning scenarios as it has formed the basis for resource, problematic issues have been noted. To begin with, the LOM conceptual data schema (the stated aim of which is to "ensure that bindings of learning object metadata (LOM) have a high degree of semantic interoperability" IEEE, 2002, section 1.2) is not based on an abstract model shared with other metadata schema. Essentially it is impossible to import elements from other metadata schema, such as Dublin Core or schema developed to support specific resource types such as images or specific features about these learning scenarios such as rights management or preservation. This is especially problematic since it is necessary for the LOM to accommodate general and non-educational characteristics (e.g. technical, rights, accessibility, etc) within the standard data schema rather than importing solutions from other domains.

We believe that IEEE LOM is mostly suitable in general for defining complex learning processes; nevertheless personalization capabilities are clearly insufficient for describing the complex requirements of ach learning scenario. Although LOM can be used for describing the learning scenarios, the description of the elements is not a simple process. Seven main levels of description can be identified. Each learning scenario is described using the following categories (See Appendix A):

General: This category identifies the general information that describes this case as a whole. It poinst towards features such as description, target audience, key words and source materials about the case study.

Life Cycle: This category describes the history and current state of the case and includes information about the status and date of the case study.

Meta-Metadata: This category describes the metadata record itself rather than the case that this record describes. This category describes how the metadata instance can be identified, how, when and with what references. This category is needed to ensure reutilization of learning resources in different contexts. The LOM standard defines a structure for interoperable descriptions of learning scenarios. Metadata for a learning scenario describes relevant characteristics of such scenarios to which applies, pursuing reusability.

Educational: This category describes the key educational or pedagogic characteristics of this case. It describes the different interaction levels and types between users.

Rights: This category describes the intellectual property rights and conditions of use for this case.

Classification: This category describes where this case falls within a particular classification system.

Other: This section provides the information required for a case to be completed. Any extension to include a more comprehensive description of terms is included in the 'other' category.

While LOM supplies the required information that can allow to build up a learning scenario, this extended version that we built up for the LLL3D project offers richer structures and takes into account other important features of a case study such as interests, success, failures and reflections. Furthermore, the inclusion of the category such as 'Other' into our model for educational metadata highlights the importance of some types of metadata that have, perhaps, been regarded as secondary metadata in the past, but which increasingly appear to be of primary importance to education. Indeed, it seems to follow from the working definition of learning materials as "anything used for teaching and learning" that the defining educational characteristics pertain not to the material itself but to the use of that material. We think that the relevant metadata schemas are those describing also the success and failure elements of a particular learning scenario.

We believe that such an extended metadata scheme does not only make a scenario easier to read and use, but also is able to incorporate new services and functionalities when required. For instance, Web 2.0 tools and other collaborative tools can be embedded within the learning scenarios (See Appendix A).

6. Future challenges

As Barker (2008) claimed, metadata requirements for educational resource types and purposes are not well understood and are less well articulated. Pinning down the details of which educationally significant characteristics pertain to which entities in learning scenarios and which relationships are important is a crucial step in understanding what information is needed to create resource descriptions that meet educational requirements, and how to go about gathering that information. For example, information about how a resource is used in a particular scenario,such as what course is it used for and the subject and educational level of that course, may be gathered by course management systems such as VLEs or MLEs, but this information is rarely, if ever, passed back to the system that manages the resource descriptions, i.e. the repository or catalogue.

The rationale for the latter example is that the quality of the search can be enhanced by aggregating the contents of several repositories; hence the service offered, can be enhanced by aggregating information about usage from several systems. As well as being distributed across many systems it is highly likely that the metadata will be heterogeneous: different systems will record different metadata and make it available in different formats. The concepts of the semantic web may be useful in dealing with such distributed heterogeneous metadata but this has yet to have much impact in practice, particularly in the educational domain.

Another observation made during the LLL3D project on metadata requirements for virtual world learning scenarios is that when precise metadata requirements are not well articulated for a particular scenario it is often common practice to provide descriptions in the form of free text. The original rationale for creating structured metadata was to record resource descriptions that were machine readable without some form of computational semantic analysis of free text. Key to this requirement is the assumption that a computer will be taking action on the basis of information conveyed in a resource description (for example selecting an appropriate resource for a given scenario) rather than a human taking this action. However, it is quite possible that in many cases it may be sufficient to find a description of the right thing (in terms of an entity or relationship in a scenario) and to present this in human readable form to the user who can then take action. This reduces the role of metadata to the well-understood role of supporting resource discovery, i.e. allowing the user to find the human readable description.

Also, we think that highly relevant to situations when precise metadata requirements are not widely agreed are approaches such as (social) tagging and folksonomies. These allow users, or groups of users, to apply descriptive keywords to resources without worrying about the details of the precise relationship between the concept expressed by the keyword and the resource. The users also do not necessarily have to agree with others about what term should be used to express the concept,though many of the systems that implement tagging approaches also include mechanisms for identifying commonly used tags for each resource, which can be useful in identifying any emerging consensus about which terms are appropriate.

7. Closing observations

Virtual worlds are becoming true learning scenarios for both blended and pure virtual distance education. Any learning scenario pertaining to virtual worlds should ensire a proper development for each learner, taking into account possible learning activities along with their success and failure aspects. As activities rather than content are crucial for interactive learning in virtual worlds, traditional metadata specifications need to be rethought in order to incorporate this vision.

In many ways the IEEE LOM standard appears to be based on a coherent record describing all aspects of a "learning scenario" and its use, complying with a single standard. We envisaged the description of any characteristics in the learning scenarios related to virtual worlds that was not already included in the LOM conceptual data schema as being achieved by extending that schema. By adopting an approach of "mixing and matching" metadata schema we can move away from this single schema approach and towards one where metadata from different schema can be mixed if they are based on a unifying abstract model.

8. Appendix A – Sample metadata scheme for a virtual world learning scenario

Must (x) Can (o)	Field Name	Description	Datatype	Value
X	**Identifier**	A globally unique label that identifies this case	CharacterString (smallest permitted maximum: 500 char)	5-14-2008-11-KCL
General This category identifies the general information that describes this case as a whole.				
X	**Title**	Name given to this case	LangString (smallest permitted maximum: 1000 char)	Wikitecture
X	**Language**	The primary human language or languages used within this case to communicate to the intended user	CharacterString (smallest permitted maximum: 100 char)	"en-GB"
X	**Description**	A textual description of what the case is about	LangString (smallest permitted maximum: 2000 char)	"Improving Architecture and City Planning by Harnessing the Ideas behind Mass Collaboration, Social Networking, Wikis, Folksonomies, Open Source, Prosumers, Networked Intelligence, Crowd Sourcing, Crowd Wisdom, Smart Mobs, Peer Production, Lightweight Collaboration, Emergent Intelligence, Social Production, Self-Organized Communities, Collective Genius, Loose Networks of Peers, Collaborative Infrastructures, Open platforms, Wiki Workplace, Open Innovation, Horizontal Networks, Collective Intelligence, Global Innovation Networks, Swarm Intelligence, Decentralized Collaboration, Participatory Culture, Web 2.0...and the like."
X	**Keyword**	A keyword or phrase describing the topic of this case	LangString (smallest permitted maximum: 1000 char)	MUVEs, architecture, design, collaboration, wiki, 3D, prototyping
O	**Structure**	Underlying organizational structure of the learning objects involved in this case	atomic: an object that is indivisible (in this context). collection: a set of objects with no specified relationship between them. networked: a set of objects with relationships that are unspecified. hierarchical: a set of objects whose relationships can be represented by a tree structure. linear: a set of objects that are fully ordered. Example: A set of objects that are connected by "previous" and "next" relationships.	Networked

Must (x) Can (o)	Field Name	Description	Datatype	Value
X	**Entity**	The identification of and information about entities (i.e., people, organizations) contributing to this case	CharacterString (smallest permitted maximum: 1000 char)	This project is primarily run by Beyond Distance Research Alliance in Leicester University and is connected to other MUVE projects through the JISC-Emerge U&I programme.
X	**Contact person**	Who? Or organisation?	LangString (smallest permitted maximum: 1000 char)	Scott Chase Email: s.c.chase@strath.ac.uk Phone: +44 141 548 3007 Skype: ScottChase SL: Scooter Gaudio
O	**Contact links**	Others associated to project?	Text	Ryan Schultz and Jon Brouchoud
X	**Target group**	Sector |	Multiple choice from fixed list	☒ HE ☐ CE ☐ AE ☐ VT ☐ IGL
X	**Aggregation level**	The functional granularity of this case	Multiple choice from fixed list	☐ Individual ☐ Session ☐ Course ☒ Institutional
X	**Source materials**	Supporting documents and resources	Text	Studio wikitecture blog: http://studiowikitecture.wordpress.com/ Related site: http://www.virtualsuburbia.com/
Life Cycle This category describes the history and current state of the case.				
X	**Status**	The completion status or condition of this case	Text	Ongoing
X	**Contribute**	Those entities (i.e., people, organizations) that have contributed to the state of this case	Text	Leicester University Beyond Distance Research Alliance School of Archeology & Ancient History London South Bank University
O	**Date**	The start date	DateTime	2008-01-18
Meta-Metadata This category describes the metadata record itself rather than the case that this record describes. This category describes how the metadata instance can be identified, how, when and with what references.				
X	**Metadata Schema**	The name and version of the authoritative specification used to create this metadata instance.	CharacterString (smallest permitted maximum: 30 char)	"LOMv2.0"

Must (x) Can (o)	Field Name	Description	Datatype	Value
X	**Language**	Language of this metadata instance. This is the default language for al LangString values in this metadata instance.	CharacterString (smallest permitted maximum: 100 char)	"en"
X	**Format**	Technical datatypes of all the components of this case	CharacterString (smallest permitted maximum: 500 char)	"video/mpeg", "application/x-toolbook", "text/html"
Educational This category describes the key educational or pedagogic characteristics of this case.				
X	**Interactivity type**	Predominant mode of learning supported by this case. "Active" learning (e.g., learning by doing) is supported by content that directly induces productive action by the learner. An active learning case prompts the learner for semantically meaningful input or for some other kind of productive action or decision. Active documents include simulations, questionnaires, and exercises. "Expositive" learning (e.g., passive learning) occurs when the learner's job mainly consists of absorbing the content exposed to him (generally through text, images or sound). A case displays information but does not prompt the learner for any semantically meaningful input. Expositive documents include essays, video clips, all kinds of graphical material, and hypertext documents. When a case blends the active and expositive interactivity types, then its interactivity type is "mixed".	Text	· simulation (manipulates, controls or enters data or parameters); · hypertext document (reads, navigates); · video (views, rewinds, starts, stops); · audio material (listens, rewinds, starts, stops).
X	**Interactivity level**	The degree of interactivity characterizing this case	Multiple choice from fixed list	☐ very low ☐ low ☐ medium ☒ high ☐ very high
X	**Intended end user role**	Principal users for which this case was designed	Multiple choice from fixed list	☐ Teacher ☐ Author ☒ Learner ☐ Manager
X	**Context**	The principal environment within which case is intended to take place	Text	Higher education

Must (x) Can (o)	Field Name	Description	Datatype	Value
X	**Typical age range**	Age of the typical intended user This data element shall refer to developmental age, if that would be different from chronological age.	LongString (smallest permitted maximum: 1000 char)	20-27
X	**Difficulty**	How hard it is to work with or through this case for the typical intended target audience?	Multiple choice from fixed list	☐ very easy ☐ easy ☒ medium ☐ difficult ☐ very difficult
Rights This category describes the intellectual property rights and conditions of use for this case.				
O	**Copyrights & other restrictions**	Whether copyright or other restrictions apply to this case	Multiple choice from fixed list	☒ Yes ☐ No
Classification This category describes where this case falls within a particular classification system.				
O	**Purpose**	The purpose of classifying this case	Multiple choice from fixed list	☒ Discipline ☐ Idea ☐ Prerequisite ☒ Educational objective ☐ Accessibility ☐ Restrictions ☐ Skill level ☒ Competency
O	**Taxon**	A particular term within a taxonomy. A taxon is a node that has a defined label or term.	CharacterString (smallest permitted maximum: 500 char)	{["12",("en","Architecture")], ["23",("en","Design")], ["34",("en","Collaboration")], ["45",("en","SL-tivities")]}
Other This section provides the information required for a case to be completed.				
X	**Mode**	SL/RL/VL/Blended	Text	Blended
X	**Interest**	Reasons we are interested	Text	"This is a rich case study for looking at collaborative design and how students have been working together inside Second Life."
O	**Successes**	What worked?	Text	
O	**Failures**	What did not?	Text	
O	**Reflections**	What were lessons learn?	Text	
X	**Tools**	Which tools and services have been used?	Text	Project blog: SL Project wiki: SL

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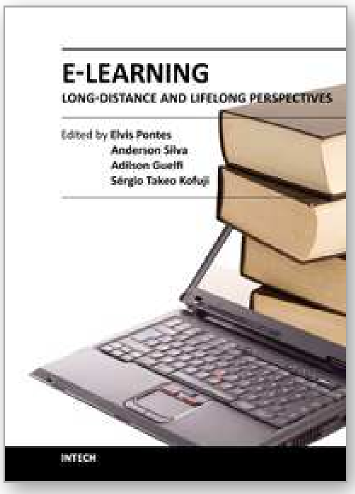

E-Learning - Long-Distance and Lifelong Perspectives

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E-learning enables students to pace their studies according to their needs, making learning accessible to (1) people who do not have enough free time for studying - they can program their lessons according to their available schedule; (2) those far from a school (geographical issues), or the ones unable to attend classes due to some physical or medical restriction. Therefore, cultural, geographical and physical obstructions can be removed, making it possible for students to select their path and time for the learning course. Students are then allowed to choose the main objectives they are suitable to fulfill. This book regards E-learning challenges, opening a way to understand and discuss questions related to long-distance and lifelong learning, E-learning for people with special needs and, lastly, presenting case study about the relationship between the quality of interaction and the quality of learning achieved in experiences of E-learning formation.