Open University of Cyprus

Faculty of Pure and Applied Sciences

Master Thesis
on Information Systems

An Online Environment of Synchronous Collaborative Learning

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August 2012

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This Master Thesis was submitted
for the fulfillment of requirements for attaining

MSc degree
on Information Systems

from the Faculty of Pure and Applied Science
of the Open University of Cyprus

August 2012

Summary

As it would be expected, education could not remain unaffected by the rapid progress of the recent decades in the field of computers, communications and especially, the Internet. The purpose of this work is the configuration of the new possibilities for communication and collaboration are now open in the field of education through the combined use of Web 2.0 tools and e-learning standards.

For this purpose, the e-learning standards: IMS LD and SCORM were examined. A comparison made between them, illustrated that Learning Scenarios which are compatible to IMS LD Specification can more easily be adapted to each individual by presenting learning materials, according with one or several characteristics of the student. Additionally, the Authoring Tools were examined, that are used to produce Units of Learning which are compliant with the IMS Learning Design specification namely: Reload and ReCourse LD Editor. Also, the Sled and Reload players were examined that are used to 'run' those UoLs. Then, the degree of interoperability of the IMS LD Specification has been tested, between SLed and Reload LD players. Despite the high percentage of interoperability, UoLs have been detected that are not interoperable in both players. Furthermore, the appropriate learning scenarios that make use of Web 2.0 tools in the form of widgets have been written and the corresponding IMS LD compliant Units of Learning were created that support collaborative learning and adaptive learning.

At the end, the ways of editing the UoLs were described in order to be reused, as well as some evaluation method were proposed. Also, the ways in which widgets can be embedded in UoL were described, for mobile learning purposes.

Acknowledgments

I would like to express my deep gratitude to my supervisor, Professor Thanasis Hadzilacos for his continuous encouragement and help. I also wish to thank Anna Mavroudi for all her help, and guidance. Her valuable knowledge and support were important for my research.

Lastly, to my husband, my family and my friends a special acknowledgement for their continuous help, support and solidarity.

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Panagiota M. Panteli

Nicosia, August 2012.

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Chapter 1
Introduction

As it would be expected, education could not remain unaffected by the rapid progress of the recent decades in the field of computers, communications and especially, the Internet. Through the new possibilities in the field of ICT, the Internet offers synchronous and asynchronous communication and speedy exchange of information, provides tools to the teacher that enable him to overcome many of the limitations of traditional education and make learning more attractive.

1.1 Generally

The computers, that are now an integral part of the educational process can enhance collaborative learning as a learning strategy. Collaborative learning has been proposed by many great pedagogues (Piaget, Vygotsky, Bandura) and has completed or even replaced the traditional form of teaching in which the tutor had the role of transmitting information to the students who had the role of passive receivers. In contrast, cooperation and interaction among students and the tutor, as well as among the students, enable learning by sharing knowledge, experiences and perceptions.

Towards this direction, a significant contribution is being offered by Web 2.0 tools that allow remote collaboration and online sharing of materials between users, exploiting thereby the basic principles of collaborative learning. The term Web 2.0 refers to a new generation of web services that offer to the users the ability to share information and collaborate online (wikipedia). Different types of Web 2.0 applications are available, such as blogs, chats, forums, podcasts, vodcasts, social bookmarking and microblogging. Many of the most popular websites are sites that are based on the use of Web 2.0 tools, such as Wikipedia, You Tube, Facebook, MySpace and Flickr [105]. Through these applications, the user has the opportunity to intervene in the web-based environment by editing the content. For example, authoring wiki articles, which means that the users can create or update or delete existing content.

In this framework, it is expected that the computers and the Internet play an important role in supporting and strengthening cooperation among the learners through the appropriate educational environments and scenarios that will utilize these capabilities. One approach towards this direction (which is being adopted in this thesis) is the modeling of cooperative scenarios as design templates (design patterns), standardized with the use of the standard IMS Learning Design (IMS LD). The IMS LD specification is a useful mechanism that effectively supports the implementation of collaborative scenarios, coordinates the trainees throughout the duration of the workflow of collaborative learning activities and provides desirable properties, such as interoperability and reusability of learning scenarios [61]

1.2   Scope of the Study.

The purpose of this work is the configuration of the new possibilities for communication and collaboration that are now open in the field of education through the combined use of Web 2.0 tools and e-learning standards. More specifically, the following services / tools have been integrated: chat (as a means of modern discussion), forum (as a means of asynchronous discussion) and wiki (as a collaborative authoring tool). Other, appropriate widgets (applets) can contribute positively in this direction.

An additional aim of this study is to identify the opportunities and constraints of IMS-LD specification. The compliance of the collaborative learning environment with the IMS-LD

specification for web based learning was considered as initial specification since the use of such specifications preserve desirable properties, such as interoperability, reuse, etc.

Implementation Details

This study at first ascertains the degree of interoperability and reuseability of IMS LD compliant Units of Learning between environments that are compatible with standard IMS-LD. It also includes:

- writing appropriate learning scenarios that make use of Web 2.0 tools

- creating appropriate IMS LD compliant Units of Learning that support collaborative learning and adaptive learning

- and the demonstration (demo) of the final Units of Learning (at runtime).

1.2 Structure of the Study

CHAPTER 1: INTRODUCTION

In this chapter a general description of the dissertation work is presented, as well as the scope and the main aims of the work. Furthermore, a description is given for:
- the subject of study,
- the necessity of this work and
- its structure.

CHAPTER 2: LEARNING DESIGN

This chapter includes an introduction to learning design which constitutes the base for understanding the necessity of IMS LD specification. Additionally, in this chapter the following topics are presented:
- Learning Activities,
- Creating a Learning Workflow,
- Sharing and Re-using Learning Designs.

CHAPTER 3: LEARNING OBJECTS

In this chapter a number of definitions of learning objects are presented. In addition the following topics are being discussed:
- Learning Object Characteristics (including a comprehensive description of adaptation),
- Learning Object Repositories (Open Educational Resources are also referred) and
- Reusable Learning Objects and finally Learning Objects Lifecycle.

CHAPTER 4: IMS LD AND SCORM SPECIFICATIONS

In this chapter, the IMS LD specification is described, including:
- the Analogy of the Learning Design with a Theatrical Play,
- the Conceptual Model of IMS LD Specification,
- the Levels (A,B and C) of Implementation of IMS LD.

Additionally, the definition of a Unit of Learning (UoL) is given, as well as a description of how a Unit of Learning (UoL) is built. Then, the definition of SCORM (Shareable Content Object Reference Model) is given, as well as a description of its distinct parts. At the end of the chapter, some conclusions are presented that justify the choice of IMS LD specification as the base for the research work of this thesis.

CHAPTER 5: IMPLEMENTATION TOOLS OF E-LEARNING SPECIFICATIONS

A brief description of the Learning Design Authoring Tools that were used in this thesis is given in this chapter, namely the 'Recourse Learning Design Editor' and 'Reload Learning Design Editor'. At the end, a description of the CopperCore Learning Design Engine, the Reload Learning Design player and Sled Learning Design player is given.

CHAPTER 6: INTEROPERABILITY

In this chapter, the degree of interoperability of the IMS LD Specification is tested, between SLed and Reload LD Players. Furthermore, the methodology followed for this test and its outcomes are described. Finally, the conclusions are summarized.

CHAPTER 7: WEB 2.0

In this chapter, the concept of Web 2.0 is described, as well as its defining characteristics. Following next, concepts of 'User Generated Content' and 'Social Media' are presented. Furthermore, an analysis of the most well-known Web 2.0 applications is presented, as well as their potential in general, but particularly in education. The Web 2.0 tools presented are: Blog, Wiki, Chat and Chat Rooms, Forum, Podcast and Vodcast, Social Bookmarking and Microblogging. Finally, the concept of widgets is described, as well as their use in education.

CHAPTER 8: LEARNING SCENARIOS

In this chapter, three learning scenarios created with different authoring tools are described. These are: "Powers", "Surface Area" and "Line y=ax+b".

CHAPTER 9: SCOPE AND SCALE-EVALUATION

In the last chapter, the scope and scale of the work presented at Chapter 8 are described. More detailed, suitable ways of editing the UoLs in order to be reused are described. Finally, the factors that should be taken into consideration for the evaluation of those UoLs are described, as well as some ways that can be achieved.

Chapter 2
Learning Design

2.1 Definition

The concept of learning design is not a new idea, its use for e-learning purposes is a relatively a new idea. In the traditional face-to-face teaching, many teachers are actively pursuing the process of the learning design as part of their everyday lesson planning, while other teachers take decisions (intended or not) about learning design every time they prepare a lesson [13].

The term 'Learning Design' (with capitals) and its abbreviation, LD, is used when referring to the formal specification (IMS Learning Design Specification). The term 'learning design' (without capitals) is used when referring to the human activity of designing Units of Learning, learning activities, learning structures etc.

A learning design is defined by Koper [57], as "the description of the teaching-learning process that takes place in a Unit of Learning such as a course, a lesson, a curriculum and a

learning event". Additionally, he states that "the key principle in learning design is that it represents the learning activities and the support activities that are performed by different persons (learners and teachers) in the context of a Unit of Learning".

Furthermore, Conole [24] states that "learning design refers to the range of actions associated with creating a learning activity and crucially provides a means of describing learning activities".

According to Agostino [01], a "learning design is described in terms of a notation system that represents teaching and learning practice that enables it to be shared or replicated".

Britain [13] states that: "not all learners are equally capable of effective and efficient learning on their own" and that "most if not all, benefit from some level of guidance and support". Every learner needs continuous support during the exercises he performs and feedback on the assignments he submits in order to understand where he may make mistakes and be able to correct them. This way the learner will be able to develop his skills and improve himself. The adaptive support and feedback a tutor has to offer to the learners can be addressed using IMS Learning Design.

The concept of learning design is compared with a cooking recipe [35]. If you try to cook something challenging using just a simple set of ingredients (or content), you will probably fail. On the other hand if one follows the recipe step by step, submitting the order and checking what assumptions and previous knowledge is needed, before starting with the more challenging ingredients, you will probably reach success. The same happens when promoting learning. If one follows his instinct and experience he will probably create something that suits him but this will be not the same with other people who have different tastes and needs. The success for the majority of the learners is more possible, if one uses the appropriate recipe for different meals and individual needs. As Fox [35] states: "the key is applying the right recipe for the right meal. By exercising judgment, you will be able to assemble the right learning model (recipe) for the right content (ingredients) to create effective learning for your audience (happy eaters)".

The analysis of the process of designing learning activities is encouraged by learning design, providing a framework for tutors, thus helping them to contemplate in a deeper and more creative way, when they design and structure activities, for different students

or group of students [91]. Effective designs may then be communicated and shared between teaching staff or retained for re-use on future occasions [13].

Although as a concept is not new in education, the central ideas behind the theory of learning design represent new possibilities for increasing the quality in an e-learning context [13]. These ideas can be summarized as follows:

1. People learn better when they are actively involved in the implementation of learning design (i.e. are engaged in a learning activity).
2. Learning activities can be organized or structured carefully in a learning workflow, in order to further improve the effectiveness of learning.
3. It would be useful to be able to store learning designs for their future sharing and re-use.

Every educator, through his experience, can realize that the most effective way for a student to achieve the acquisition of knowledge is the active involvement in the learning process. It is extremely useful for a student to acquire knowledge by experiment and be brought to the right conclusions by himself. The teaching and learning process is a 'live' process that is being constantly developed during the lesson. A lesson is never developed in the same way in two different classes since the students that are taking part have different prerequisite knowledge, social and cultural background. Thus, educator should be in alertness and capable to maneuver the teaching-learning process using different examples and activities in order to meet the students' needs. Moreover, the educator after the completion of every lesson should make an evaluation of the process in order to detect which activities, examples or questions were useful and which of them were probably unnecessary or inappropriate. Those observations are useful for the improvement of the process in case it will be reused at a later point.

On the other hand according to Koper and Olivier [60], learning design specifies the teaching-learning process. It specifies under which conditions, what activities have to be performed by learners and teachers to enable learners to attain the desired learning objectives. A learning design can refer to resources, such as learning objects and learning services, which are needed during the teaching-learning process. A Unit of Learning (UOL) is used, in order to package the learning design and the referenced physical resources. A Unit of Learning can be seen as the container of a course, a

workshop, a lesson etc. that can be instantiated and re-used many times for different persons and settings in a web-based environment [60].

2.2 Learning Activities

In any learning process, the activities (such as reading, thinking, discussing, exploring, problem solving etc), that the learners undertake are the cornerstone of the teaching –learning process. . They should provoke active learning. For the scope of this thesis, active learning is generally defined as any instructional method that engages students in the learning process. In short, active learning requires students to do meaningful learning activities and think critically about what they are doing [12]. When the learners are not active one shouldn't expect them to learn much. Bonwell and Eison [12], conclude that using techniques that promote active learning in the classroom is vital due to their powerful impact upon students' learning. Moreover, these activities promote the development of metacognitive skills.. Metacognitive skills are important not only in the school, but throughout life. It is essential for a person to learn how to learn because in this way he will be able to know the stages in the process of learning, understand his own preferred approaches to it, identify and overcome barriers to learning.

Any instructional agent, whether it is a teacher, the learners themselves or a computer, has a primary role: to stimulate the performance of learning activities that will gradually result in the attainment of the learning objectives [58]. The instruction agent [58]:

- defines the tasks
- provides the contexts and resources to perform the tasks
- supports the learner during task performance and
- provides feedback about the results

The learning activities that are needed to obtain the learning objectives should carefully sequenced according to sound pedagogical principles [58]. With regards to learning design, Heathcote [43] suggests that "an ongoing obstacle to the widespread adoption of effective and engaging learning design is the degree of pedagogical understanding required by a lecturer to make the most of the available resources". There is also a concern that before any learning activities are designed, educators must, tacitly or explicitly, know the principles of learning and how students learn [03].

2.3 Orchestrating Activities – Creating a Learning Workflow

In addition to learning activities, another important feature for successful teaching, is the order (sequential or conditional) and the timing of the various activities as well as the presentation of the resources that are needed to support them. This procedure is called 'orchestrating of activities'. The orchestration of learning activities can result in a simple sequential flow or it may sometimes involve conditional branching of workflows into parallel activities that are undertaken by sub-groups. For example, a learning design may also be constructed in a way that allows different routes to be taken based on achievement at a testing stage within a learning sequence [13]. In the learning scenarios that will be described at chapter 8, the orchestrating of activities, involves sequential flow in the first two learning scenarios and conditional branching in the third scenario. The conditional branching was implemented through the "if-then-else" construct that is compatible with the IMS LD specification ('Powers', 'Surface Area' and Line y=ax+b').

From the teacher's perspective there are two main advantages associated with the process of designing the learning activities [13]:

1. it provides a framework for teachers to reflect in a deeper and more creative way about how they design and structure activities, for different learners or group of learners and
2. Learning Designs (i.e. UoLs) or learning designs (i.e. textual or visual representatives o fthe teaching-learning process) that prove to be effective may then be communicated and shared between teachers or stored for re-use on future occasions.

2.4 Sharing and Re-using Learning Designs

It is not so easy to describe a given learning design in a consistent and transferable way that will allow easy re-use. The design, pattern or recipe needs to be described at a sufficient level of abstraction that it can be generalized beyond the single teaching and learning context for which it is created, but not at such an abstract level that the pedagogical value and richness is lost. When thinking about creating, transporting, and re-using learning designs in electronic learning environments this problem is exacerbated [13]. IMS-LD is intended to solve this problem by providing a formalization of the teaching-learning process using a metaphor of a theatrical play.

Sharing of learning designs can be performed through the LAMS (Learning Activity Management System). According to LAMS Foundation [66], "it is an open source Learning Design system that is used for designing, managing and delivering online collaborative learning activities". These learning activities include: a range of individual tasks, small groups work as well as whole class activity based on both content and collaboration [114], [65]. The LAMS Community for example, has a central repository of learning designs (http://lamscommunity.org/lamscentral/?language=el) that allows teachers to share and adapt digital lesson plans, as well as describing their experiences of using LAMS. Digital learning activities are freely available online in order to be used and adapted by teachers, trainers and professors and they can share their own and adaptations [66].

Sharing learning designs that have been previously used and proven successful is a means of disseminating innovation and best teaching practice whilst at the same time conserving teacher time and effort [21]. Philip and Cameron [85] have well documented the benefits of sharing and re-using learning designs. As it has been stated before sharing and re-using can conserve time and effort in creating learning designs by:

- providing exposure to model of best practice
- providing scaffolding and mentoring for new teachers
- becoming a source of inspiration to even experienced teachers
- facilitating collaborative review, reflection and evaluation of learning designs
- allowing learning designs to be meaningfully archived and catalogued and
- facilitating communities, professional and students networks

Chapter 3
Learning Objects

3.1 Definitions of Learning Objects

Currently, there are many definitions of Learning Objects. Some of them are:

1. "A Learning Object is defined as an entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning" [45].

2. Wiley [118] focuses on the re-usability aspect. "A Learning Object is any digital resource that can be reused to support learning. This definition includes anything that can be delivered across the network on demand, be it large or small. Examples of smaller reusable digital resources include digital images or photos, video, text or Java applications. Examples of large reusable digital resources include entire web pages that combine text,

images and other media or applications to deliver complete experiences, such as a complete instructional event".

3. "An independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts" [87].

4. Another perspective compares learning objects to LEGO building blocks: small units that can be fitted together and number of ways to produce customized learning experiences [44].

5. "A learning object is defined as the smallest independent structural experience that contains an objective, a learning activity and an assessment" [63].

6. According to Mohan and Greer [73], a learning object is a digital learning resource that facilitates a single learning objective and which may be reused in a different context.

The first three definitions emphasize the reusability as a quality characteristic of learning contents and activities. Nevertheless, a learning object should be distinguished from an "information object"— which might have an illustration or other materials attached to it — or from "a content object" such as a video or audio clip, picture, animation, or text document. The key distinguishing feature between these kinds of objects and a learning object is the clear connection to a learning objective [53]. For the scope of this master thesis the definition 6 is adopted which is based on this point of view because "without a clear and measurable educational objective, the collection remains just collection" [96]. In conclusion, according to the above definition, a Unit of Learning is a Learning Object but not vice versa. A Learning Object is not necessarily a Unit of Learning.

3.2 Learning Object Characteristics

Learning objects have a number of characteristics, the common ones are [67]:

- **Accessibility:** the learning object can be identified and located when it is needed and as it is needed. It is an important characteristic because the instructional components are often accessed from one remote location and may be delivered to other locations. For example,

access a learning object from a repository and deliver it to an online course management system, like a moodle instance.

- **Interoperability:** instructional components developed in one location, with one set of tools or platform are used in another location, with a different set of tools or platform [67].

- **Reusability:** the learning object can be used for different learners in different contexts.

- **Durability:** the learning object does not require modifications to operate as a software system are changed or upgraded.

- **Adaptability:** ensures the learning object is tailored for the individual and situational needs.

- **Affordability:** increase learning effectiveness significantly while reducing time and costs (ADL).

3.2.1 Adaptation

There are many definitions of adaptation in eLearning systems. Adaptivity and adaptability are the two main terms that are closely related and are usually involved [22]. According to Burgos et. al. [19], adaptivity in learning is the ability to modify eLearning lessons using different parameters and a set of pre-defined rules. Adaptability is the possibility for learners to personalize an e-learning lesson by themselves. The word adaptation is used to cover the various approaches [19]. Ruiz et. al. [94] state that, "one key element to consider when developing eLearning systems, is the adaptation of the system to the cognitive characteristics of the students". Making this adaptation it implies the study and conjunction of technical and pedagogical aspects.

Eight types of adaptation in eLearning systems have been proposed [18]:

1. **Interface-based:** elements and options of the interface are positioned on the screen and their properties are defined (color, size, shadow etc.) [02].
2. **Learning flow-based:** the learning process is dynamically adapted to sequence the contents of the course in different ways.
3. **Content-based:** resources and activities dynamically change their actual current learning material.

4. **Interactive problem solving support:** guides the student on the next step to take in order to get the right solution in a problem (on-line or off-line tutor or predefined set of rules) [16].

5. **Adapting information filtering:** care is taken of appropriate information retrieval that provides only relevant and categorized outputs to the user [08].

6. **Adaptive user grouping:** allows ad-hoc creation of user groups and collaborative support on carrying out specific tasks.

7. **Adaptive evaluation:** the evaluation model, the actual content and the running of test can change depending on the performance of the student and the guidance of the tutor [108].

8. **Changes on-the-fly:** the possibility to modify/adapt a course on-the-fly by a tutor or the author of the course in run-time [107], moving beyond the previous types which are set up and defined in in design-time [68], [93].

Some of the above types of adaptation are well supported, some others are partially supported and some of them are not supported by IMS-LD specification. More specifically:

- **Well supported:** learning flow-based, content-based, interactive problem solving support.

- **Partially supported:** adaptive user grouping, adaptive evaluation, changes on-the-fly (The specification allows it, but the CopperCore engine does not so it is a limitation of the tools, not of the specification itself. Nevertheless, it is partially supported since a learning designer is able to perform modifications on the run, as long as they are planned before hand).

- **Not supported:** interface-based (not supported by IMS-LD compliant tools, although the CopperCore engine provides the appropriate interface), adaptive information filtering.

3.3 Learning Objects Repositories (LOR) and Reusable Learning Objects (RLOs)

Learning objects need to appear in collections that are easily accessible and searchable by the intended users, in order for their potential utility to be fully realized. Individual learning objects that are not hosted in a repository are more difficult to be located and utilized from those users beyond those for which the learning objects had been originally designed. Neven and Duval [75],

state that "LOR allows registered or unregistered users to search and retrieve LO's from the repository. Searching for LO's is based on criteria that relate to metadata elements. Simple and advanced queries may be supported by the LOR, as well as browsing through the material by subject or discipline or other fields. Several repositories exist on the Web which are open to public access. Furthermore, there are also 'private' repositories which require fees for use [74].

A digital repository offers a set of tools for storing, indexing and locating stored documents which favors the collection, access and sharing of their content. This space is employed by the LOR users, to publish and download the Los published by other users. These interactions encourage the exchange, evaluation and reuse of Learning Objects [69].

Associating and storing metadata about the learning object enable a course designer to search for and locate existing LOs. With regards to the use of metaldata, the Learning Object Repositories are of two types [23]:

- The first type contains only the metadata for learning objects such as MERLOT http://www.merlot.org. The actual LOs are stored in various locations and are being referenced in the repository.
- The second holds both the metadata and the learning objects in one location. An example of this type of repository is DSpace open software (http://dspace.ou.nl/). Dspace consist of organized communities and collections that are open to the public. Thanks to this organization a number of IMS-LD compliant Units of Learning, were easily downloaded from this specific repository for the purposes of this master thesis. These UoLs were all located in one digital collection of the repository, from which they were retrieved (http://dspace.ou.nl/handle/1820/16).

We have conducted a review of the available Learning Object repositories. The results are summarized below:

1. **Jorum** (http://www.jorum.ac.uk/). Funded by JISC, (http://www.jisc.ac.uk/) Jorum is a free online repository service, which helps in building a community for the sharing, reuse and repurposing of teaching materials. Jorum offers the capability of finding and sharing teaching resources from a wide variety of subject areas, shared by the UK Further and Higher Education community. Moreover, it allows the tutor to discuss his experiences of using digital resources

in his teaching, as well as, it provides advice on things to consider when creating shareable learning and teaching materials.

2. **Information & Computer Sciences (ICS) RLO Repository** (http://www.ics.heacademy.ac.uk/resources/rlos/finlay/index.php). The Centre Information and Computer Sciences provides a range of resources to help in teaching and curriculum development.

3. **LessonPlanz.com** (http://www.lessonplanz.com/). This repository offers online lesson plans and teaching resources.

4. **Lesson Plans Search** (http://www.lessonplansearch.com/). This site main component is a large database of Lesson Plans which can be searched in order to find the appropriate lesson plan.

5. **The University of Nottingham** (http://sonet.nottingham.ac.uk/rlos/). This site contains a repository of multimedia, interactive Reusable Learning Objects (RLOs) which have been developed through the collaboration of teachers, healthcare practitioners and software developers.

For the scope of this thesis a "Reusable Learning Object" (RLO) is any digital resource that can be reused to support Web-based learning. This includes lesson plans, case studies, quizzes, simulations or interactions [76]. A number of the existing OERs are actually repositories that contain RLOs.

6. **RLO-CETL** (http://www.rlo-cetl.ac.uk/). The CETL develops, shares and evaluates learning objects. This repository gives access to a rich set of learning objects, tools and information developed by RLO-CETL. The partner institutions are London Metropolitan University, University of Cambridge and University of Nottingham.

7. **MERLOT (Multimedia Educational Resource for Learning and Online Teaching)** (http://www.merlot.org/merlot/index.htm). It is a free and open online community of resources including collection of peer reviewed material

suitable for higher education. It contains online learning materials, catalogued by registered members and a set of faculty development support services MERLOT has been developed by the California State University Centre for Distributed Learning.

8. **DSpace** (http://dspace.ou.nl/). The Dspace repository of the Open University of Netherlands consist of organized communities and collections, some of which are open to the public. Anybody can browse and search DSpace repository, but can open or view only resources of those communities and collections. Any registered users with permission to submit items can add new items to the collections for which they are authorized.

3.3.1 Open Educational Resources (OER)

The concept of Open Educational Resources (OERs)was first introduced at a conference hosted by UNESCO in 2000, with the aim of providing free access to educational resources on a global scale [119]. A definition of OER was given by Atkins et. al., [06], that: "they are teaching, learning and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others". Furthermore, OECD [79], defines OER as "digitized materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research.

A vision to promote open education was created by the Cape Town Open Education Declaration [102] as follows: "Educators worldwide are developing a vast pool of educational resources on the Internet, open and free for all to use. These educators are creating a world where each and every person on earth can access and contribute to the sum of all human knowledge. They are also planting the seeds of a new pedagogy where educators and learners create, shape and evolve knowledge together, deepening their skills and understanding as they go".

There are several well-known programmes and projects which illustrate different approaches, models and scales of current OER initiatives, the most important of which are [119]:

- **MIT OpenCourseWare** (http://ocw.mit.edu). It is a well-known example of OpenCourseWare sharing, as well as the most copied institutional OER model. It offers

lecture notes, problem sets, syllabi, reading lists, tools, simulations, video and audio lectures.

- **OpenLearn Initiative** (http://openlearn.open.ac.uk/). It is launched by the UK Open University to make their materials available for free use worldwide by anyone accessing the site and to build communities of learners and educators, using a range of tools and strategies. The OpenLearn initiative completes the MIT by providing not only a collection of free course material but also a set of tools to help authors publish and support collaborative learning communities.

Some others well-known programmes and projects are:

- **USU OCW** (http://ocw.usu.edu/)
- **Connexions** (http://cnx.org/)
- **Open Learning Initiative** (http://www.cmu.edu/oli/)
- **OpenCourseWare Consortium** (http://www.ocwconsortium.org/)

Chapter 4
SCORM and IMS LD

According to Robinson and Anderson, [92] "RLOs are intimately involved with standards. A Learning Object that cannot be reused in a different delivery system (as well as in different content) is worthless." Standards are universal definitions agreed upon by accrediting standards bodies and specifications are suggested implementations which may develop into accredited standards. IMS Learning Design and SCORM are specifications for RLOs [92].

4.1 The IMS Learning Design Specification

The IMS LD provides a high level language, or meta-model, that can describe a wide variety of pedagogical models, or approaches to learning, including group work and collaborative learning. [52]. Specifically, the language describes how people perform activities using resources (including materials and services), and how these three things are coordinated into a learning flow. Materials can then be reused within different scenarios. The scenarios can also be reused and new materials can be added [59].

4.1.1 The Analogy of Learning Design with a Theatrical Play

IMS Learning Design specification describes how a learning design can be developed like the scenario of a theatrical play. Just as a play can be staged with different actors, in different theatres with alternative props every time, a learning design can be run again with different learners and tutors with alternative learning resources or tools [52].

Just as the theatrical play, the learning design consists of a series of acts, where the roles include, for example, the role of learner or a group of learners (like: beginners, intermediate, advanced), the tutor, the advisor, the instructor and others. A series of activities is undertaken by people playing the roles within an act. For the role of the learner an example of such an activity might include discussing with classmates the relative merit of a piece of source material, while for the tutor may be to comment on their conclusions. Within an activity each role corresponds to specific learning objectives and services (such as the communication and collaboration tools). After all the activities of a specified role or roles are finished, an act is completed. Alternatively, a time limit may be set, after which an act is completed automatically. The next act starts, when one act is completed. The play finishes when all the acts are completed. When all plays are completed the learning design finishes [52], [57].

4.1.2 The Conceptual Model of the IMS Learning Design Specification

As already discussed, the IMS Learning Design specification provides a framework of structural elements used to describe the design of a learning process.

The following elements need to be described in an IMS Learning Design:
- **Learning Objectives**
- **Roles:** There are two kinds of roles to represent people: learner or staff (which can be named as e.g. tutor, moderator, facilitator, administrator etc.). A role can be performed by more than one participants. The roles are performed together and can interact during the learning scenario [13].
- **Activities:** these can be either learning activities if they are performed by the learners or support activities if they are performed by the tutors [13].
- **Activity-structures:** is a set of activities that can be combined either as a sequence or as a selection. Sequence means that the activities occur in a specific linear and selection means

that the activities can be performed in any order. The end of act is a synchronization point, so that all persons in the roles begin a series of activities at the same time [13].

- **Environment:** It contains the Learning Objects and/or Services. The Learning Objects which would typically be external learning material or tests with optional metadata. Services which refer to a service provided within the environment that can be found in the learning design during design, instantiation or during runtime. Services for example may be discussion forums, chat rooms, monitoring tools and other features like emails, search and others [48].

- **Resources:** resources can be of five different types such as web content, imsld content, person, service facility or dossier [13].

- **Method:** The method element consists of one (play) or more plays (concurrent plays) and specifies the way of organization and coordination of learning and support activities that are performed from different roles using different learning objects and services in a consistent learning flow. The play is represented by one or more act in a sequence, each act contains one or more role-parts and each role-part associates one role with one activity or activity structure [13], [57], [100].
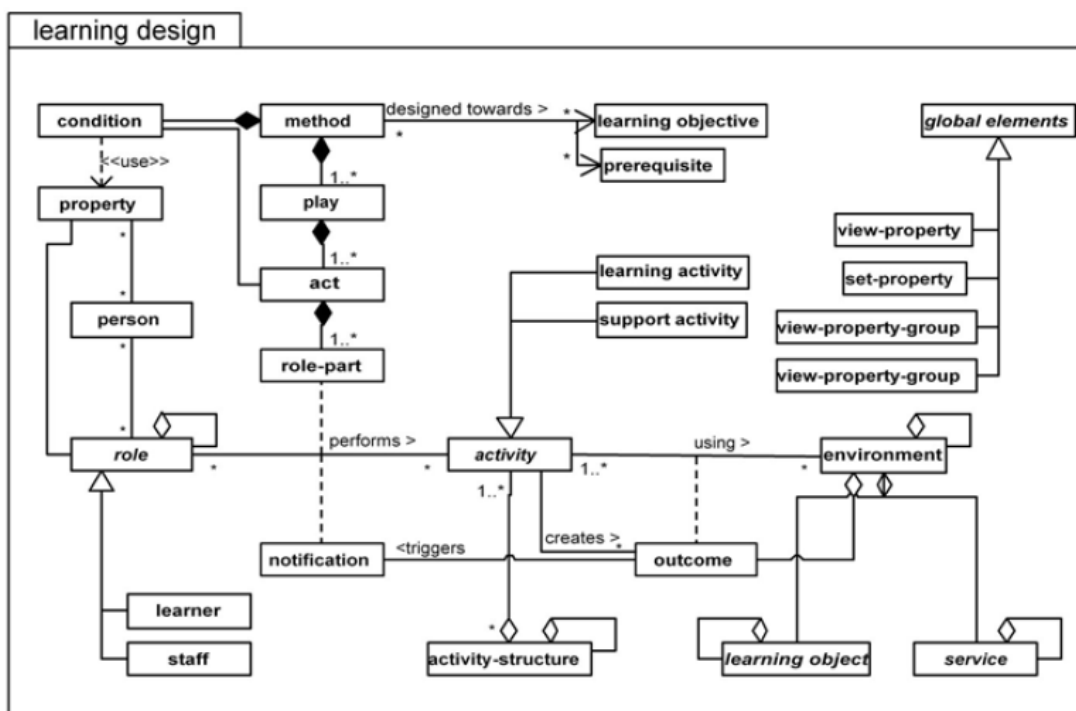

Figure 4.1: The Learning Design Information Model [61]

4.1.3 Levels of Implementation of IMS LD

There are three levels of implementation and compliance in LD: A, B and C. Level A contains the core elements of the metaphor. Level B adds Properties and Conditions to level A, which enable personalization [106].

LEVEL A

Level A contains the core of IMS Learning Design that is the minimum elements required to satisfy the requirements of the specification: people, activities and resources, and their coordination through the method, play, act and role-parts elements. This level caters for ordered learning activities performed by learners and tutors, using learning objects and services [52]. It reflects a model of an individual learner, interacting with content, without having any interactions with other learners. If multiple learners are assigned to the role, they each work with the assigned resources in isolation [47].

LEVEL B

Level B adds more control and complexity by using properties and conditions. There are two types of properties: Internal (local) and External (global). They are used to store information about a learner, such as tests results or learner preferences or information related to a role and information about the state of learning design itself. Internal properties live only for the duration of each 'run' of a learning design. External properties retain their values beyond the end of a run and accessed from different runs or different learning designs. One common use of properties is to provide more detailed information about learners to adapt a learning design to individual needs and preferences [52].

Conditions provide to the learning designers the capability to define rules as to what should happen when certain events take place. The use of properties and conditions in combination, may provide more abilities for personalization and adaptation during the learning process, assigning rules for the definition of the learning activities flow according to the preferences, certain characteristics or the learners valuation [41], [67].

LEVEL C

Level C contains the elements of the Levels A and B and additionally introduces notification or messaging both between system components and between roles (tutors and learners) providing a higher level of interaction between different role activities. Furthermore, this adds a new dimension by supporting real-time event-driven work/learning flow. It also enables the automaton of learning flow activities, which are triggered by the completion of tasks, rather than the learning flows being preplanned. For example, a teacher may be notified by email that an assignment has been submitted and needs marking. As soon as the score has been posted at the internet, the learner may be notified to undertake a new activity according to the result [47], [52].

4.1.4   Unit of Learning - UoL

As mentioned already the LD specification provides a framework of elements that describes formally the design of any teaching-learning process. The final product that is derived from the specification's implementation is called Unit of Learning (UoL). A Unit of Learning refers to a complete, self-contained unit of education or training, such as a course, a module, a lesson, etc. [61]. The creation of a UOL involves the creation of a learning design and also the bundling of all its associated resources, either as files contained in the unit or as web references, including assessments, earning materials and learning service configuration information [61].

Unit of Learning = IMS Content Package + IMS Learning Design

Figure 4.2: Unit of Learning [48]

A packaging mechanism is needed to pack the learning design and its associated files into a single container. The LD specification recommends the use of the IMS Content Packaging (IMS CP). The IMS CP specification defines a reusable content module which is called Content Package and consists of a structural file that should contain a Manifest and its associated files.

The Manifest is contained within a package as an XML file with a fixed, pre-defined name "imsmanifest.xml" (IMS CP Information Model, 2001). The file "imsmanifest.xml" together with the digital files of learning materialare packed in a package in the form of a ".zip" file, which practically consists a Unit of Learning (UoL).

The Manifest, which is the main component of a Unit of Learning, since practically it contains the structure of the UoL, includes the following elements [46]:

- **Meta-Data:** the metadata for the description of the package.

- **Organizations:** that defines a simple tree hierarchy of the package resources.

- **Resources:** a list of all the package resources.

- **sub-Manifest:** includes other Organizations elements when these are desirable.

```
<manifest>
  <metadata/>
  <organizations>
    <learning-design xmlns="[standard-namespace-for-learning-design]">
      [add learning design elements here]
    </learning-design>
  </organizations>
  <resources/>
</manifest>
```

Figure 4.5: The main structure of the Manifest file [48]

4.1.5 Building a Unit of Learning (UoL)

The IMS Best Practice and Implementation Guide [47], describes a sequence of steps that characterize the development of a learning design for a Unit of Learning:

- The first task is to analyze a specific educational problem as a use case and then turn it into a scenario describing the learning objectives and tasks or activities establishing the basic order of events that can be captured in a narrative form.

- During the design phase the narrative is cast in to a UML (Unified Modeling Language) activity diagram. This UML diagram then forms the basis for creating the XML document that implements the IMS LD Specification.

- During the last phase, the phase of development the actual content (resources) can be developed and finally a content package can be created that incorporates the learning design.

The above sequence of steps was followed for the design of learning scenarios described at Chapter 8.

4.2 Shareable Content Object Reference Model (SCORM)

SCORM is an acronym for Shareable Content Object Reference Model. SCORM at a high-level is a collection of standards and specifications that enable web-based learning systems to find, import, share, reuse, and export learning content in a standardized way. It applies the current developments in training technology through use of a specific content model to ensure consistent implementation of training across the e-learning community stakeholders.

The whole idea of SCORM is to allow learning content to interoperate across multiple products, environments and tools, and to make it easier to discover and use such content [111].

The Sharable Content Objects (SCOs) are individual, electronic Units of Learning that may be combined to create a course of study.

4.2.1 Parts of the SCORM specification

The SCORM specification consists of four parts:

- An overview of the model, vision, and future of the SCORM.
- The Content Aggregation Model (CAM), which defines how to put learning content together so it can be moved and reused.
- The run time environment (RTE), which launches content, tracks the learner's progress, and reports progress back to the LMS.
- The SCORM Sequencing and Navigation specification, which sets and governs the rules for the behaviors of aggregations of SCOs within a SCORM-conformant environment.

Together, these four parts provide a common standard for development and delivery of learning content for ingesting, cataloging, and rendering in a conformant learning management system (LMS).

Content Aggregation Model (CAM)

Content Aggregation model defines how to package together a collection of learning resources, their metadata, and how these lower-level sharable, learning resources are aggregated into higher-level units of instruction. The Content Model also contains information about how the content is to be delivered to the user.

SCORM Run-Time Environment

For a SCORM package to be reusable and interoperable across multiple Learning Management Systems (LMSs; moodle, http://moodle.org/, for instance) there must be a common way to initiate learning recourses, a common mechanism for learning recourses to communicate with an LMS and a predefined language forming the basis of the communication. The Run-Time Environment specifies three components that enable these functionalities respectively.

Sequencing and Navigation

Sequencing happens between SCOs and outside of SCOs. When a learner exits a SCO, sequencing is responsible for determining what happens next. Sequencing determines what navigational controls and options are available to the learner [81].

When accessing SCORM content, a learner will experience only one learning object at a time. The SCORM Sequencing and Navigation section defines the ability of a learner to navigate from one learning object to another and the sequence in which learning objects may be experienced by a learner.

4.3 Conclusions

IMS Learning Design (IMS LD) and the Sharable Content Object Reference Model (SCORM) are the most widespread standards for e-learning. The basic similarities between IMS LD and SCORM can be summarized as follows:

- they can both guide the development of educational materials,
- both use a number of specifications to achieve their goals and
- both lead to content packages, (UoL for IMS LD and SCO for SCORM) which can be imported and 'played' by players.

However there are important differences between IMS LD and SCORM. SCORM describes the behavior of a single learner, whereas IMS-LD allows learning flows that involve groups of learners. Because of the single-user restriction SCORM it has to rely on the implementation of the LMS for certain tasks like manually grading and supporting students whereas, these, can be modeled with IMS-LD because IMS-LD can, for instance, show or hide activities based on learner performance [99]. This brief comparison illustrates that Learning Scenarios compatible to IMS LD Specification can more easily be adapted to each individual by presenting learning materials and learning services, according to one or several characteristics of the student. IMS LD give the learning designer the opportunity to set up a UoL that allows the learner to follow different path of activities through it base on his learning characteristics and styles. This is important since students may have different learning aims, backgrounds, knowledge levels, learning styles, and competencies. A web-based course intended for a certain group of students may not suitable for other students. Therefore a learning scenario is urgent to be adaptive so that different students obtain different learning materials, feedback and services [31].

Chapter 5

Implementations of the IMS-LD Specification

5.1 Learning Design Authoring Tools

The Learning Design authoring tools are software packages that help producing pedagogical content quickly and efficiently. There are learning design authoring systems that can be used by users, who may not have competent technical knowledge, as well as systems that are designed to be used by people with technical knowledge about computers and programming.

Griffiths et. al. [38] classify the authoring tools to two categories:

- "low level" tools, that use a presentation of terms and structures close to the IMS LD specification. The target for this category is the users who have a detailed knowledge of IMS LD specification.

- "high level" tools, that use a presentation of terms and structures distant from the IMS LD specification and also utilize a "hidden mapping" between the interactions of the users and the mechanism that actually implements the IMS LD specification. The target users are those who are not familiar with the IMS LD specification. Therefore, the IMS LD structure and terminology are considered inappropriate for them. In order to be easy to use, these "high level" tools integrate vocabularies and representations well recognized by users.

5.1.1 ReCourse Learning Design Editor

ReCourse is a freeware and cross-platform application, developed as part of the European-funded TENCompetence project. It is written in Java using the Eclipse Rich Client Platform framework. The latest version was released in January 2009 [97]. It is a tool which teachers can use to produce Units of Learning which are compliant with the IMS Learning Design specification. It is designed to support teachers and learning designers in the organization and coordination of learning activities and aspects of the learning environment.

A learning design, as produced by the ReCourse editor, consists of a description of how a learning objective is addressed by people in roles carrying out activities with learning resources and using tools and services (e.g. mail or a forum). This means that any system which uses the language can save, open and run UoLs created with ReCourse [95].

The ReCourse allows to integrate external resources (objects, links, etc.) and services (search & browse etc.) in the planning of the educational process.

The Recourse Learning Design Editor provides the user with a number of templates that are divided into the following categories:

- Basic
- Trainer driven modes
- Discussion oriented models
- Collaborative assessment-driven models
- Assessment model driven
- Adaptive driven models

For example, some of the templates belong to the "Trainer driven modes" are the following:

- Socratic Questioning 1
- Inquiry Based Learning
- Jigsaw

Some of the templates belong to the "Discussion oriented models" are the following:

- Brainstorming
- Debate
- 360 Degree Feedback

The template that belongs to the "Collaborative assessment driven models" category is titled: **Peer Learning**.
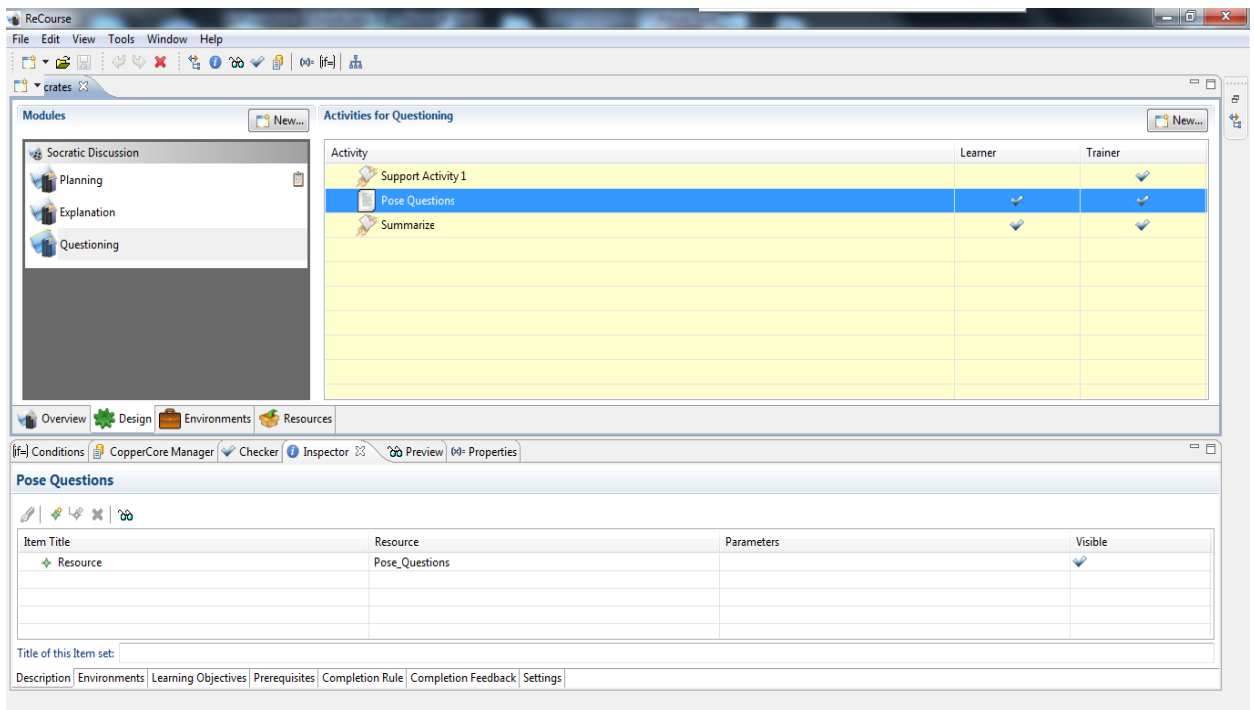

Figure 5.1: The ReCourse Learning Design Editor environment

5.1.2 The Reload Project and Reload Learning Design Editor

The Reload Project

Reload (Reusable E-Learning Object Authoring and Delivery) is a project funded under the JISC Exchange for Learning Programme and managed by the University of Bolton. The project focuses on the development of tools that are based on emerging learning technology interoperability specifications (namely: IMS-LD and SCORM).

The primary aims of this project are to [88]:

- facilitate the creation, sharing and reuse of learning objects and services
- enhance the range of pedagogical approaches realisable through the use of lesson plans

Reload Tools

RELOAD focuses on developing open source tools for learning objects packaging and delivery, like:

- Metadata and Content Packaging Editor.
- Learning Design Editor.
- SCORM Player.
- Learning Design Player.

The Reload LD Editor

The Reload LD Editor allows the user to define a set of Learning Objectives, Activities and Learning Environments in order to create re-usable "Pedagogical Templates". These templates can be re-purposed with the user's own content to create on-line Learning Design compliant resources [89].

The Reload Learning Design Editor Supports the full IMS Learning Design specifications for Levels A, B and C [90].

The Reload Learning Design Editor is a freeware software, aimed at technical staff within groups developing eLearning courses, who have high level of technical knowledge, but not necessarily programming skills [37]. The user starts off with an empty Learning Design and adds the relevant elements (along with values) as required. The tools structure the Learning Design by only

allowing valid structures (for instance, only allowing Roles to be added in the relevant section). Where an element has a restricted vocabulary, the choices are limited through the use of drop down menus [71]. The Reload Learning Design Editor workspace is shown in Figure below.
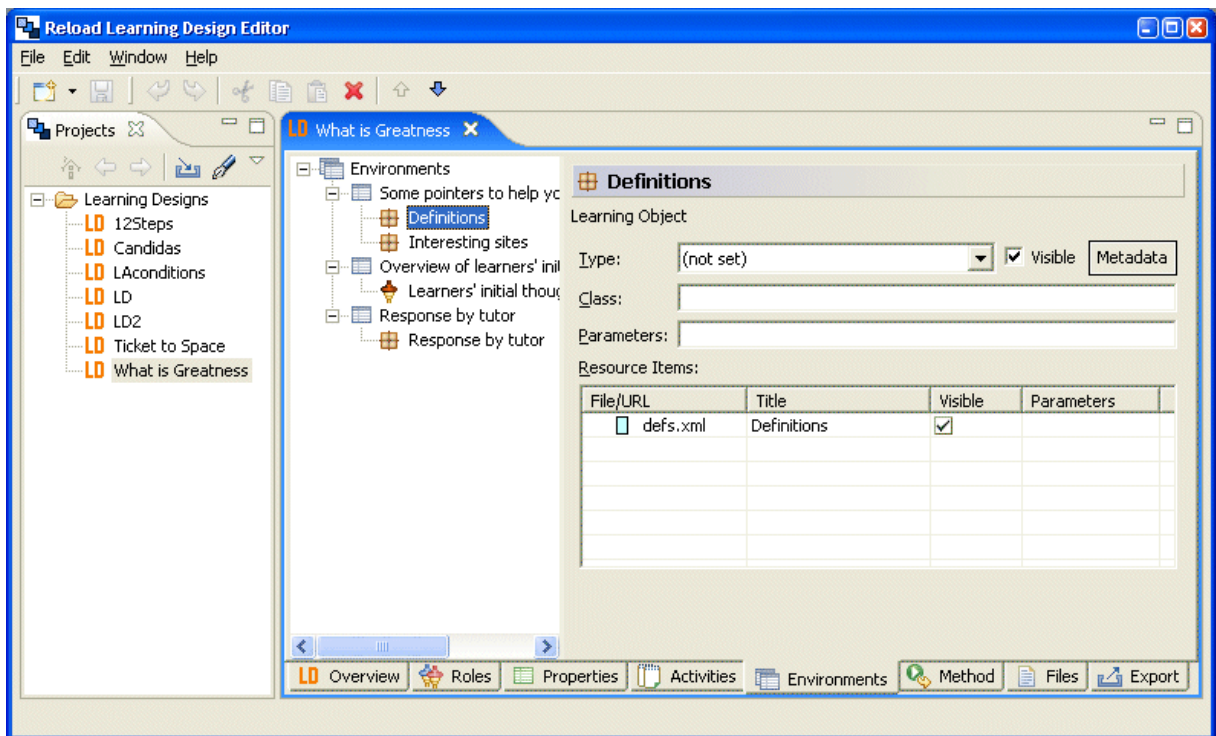

Figure 5.2: The Environments page of the Reload Learning Design Editor
(http://www.reload.ac.uk/ldeditor.html)

5.2   Learning Design Engine and Players

According to Harrer et. al. [39]: "A learning design engine is the specification of the learning flow (as LD documents) and learning environments. According to its current state, the engine controls the learning environment with events (such as "start a new phase"), defined as a vocabulary for a set of environments, that are mapped to the environments' existing functionality (such as "create new workspace"). Thus the engine remotely controls the learning tools while the tools can initiate state transitions in the engine on specific events in the tool. "An engine is needed to present the learning activities to learners as expressed by a UoL. The output of the engine will be a personalized version of the UoL in XML format according to the rules defined by LD [109].

5.2.1 CopperCore Engine

If the LD specifies, for example, a group assignment where all learners need to complete a particular activity before they can continue to the next one, the runtime environment should continuously check to find out if all users did already complete their first activity in order to be able to synchronize access to the second activity. All this checking, synchronizing and personalizing is called the business logic of Learning Design, and this is exactly what the CopperCore Engine handles. It supports dynamically checking and personalizing the activity workflow in an IMS LD compliant UoL [26].

Coppercore is the engine responsible for pre-processing a UOL. This process is called publication process. The first step of the publication process is to check the UOL validity. The UOL is checked for completeness; that is, whether all locally referenced resources are also included in the UOL package [27], [61].

The CopperCore Engine (which is actually a reference engine for the IMS LD specification) has a validation routine for the manifest file ensuring that the package is complete, the learning design is well formed and valid against the schema and the learning design is semantically correct. Validation includes two types of check: technical and semantic checks and the detected errors are reported back to the user. A type of semantic validation includes the checks for invalid attribute values: for example, if the minimum number of people specified in a role exceeds the maximum number. ReCourse LD Editor prevents such errors by not allowing for example the instructional designer to insert minimum number of people greater than the maximum number (fig. 5.3) [27], [61].
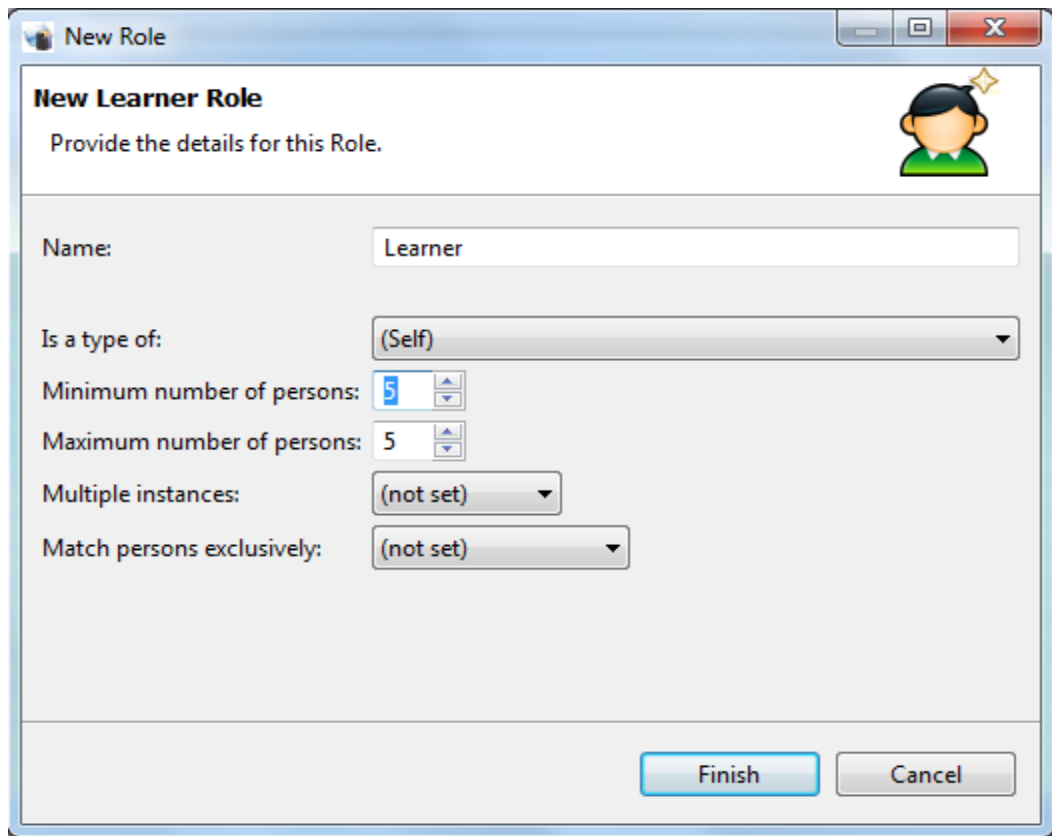
Figure 5.3: The ReCourse LD Editor do not allow the instructional designer to insert invalid values.

If the validation is successful, the LD parser is invoked and the 'imsmanifest' file is imported into the Learning Design Player [27], [61].

The CopperCore engine developed by the Open University of Netherlands (OUNL) and supports all three levels of IMS LD specification (A, B and C). It has built-in support for three relational databases (MS SQL Server/MSDE, Postgre SQL and HSQLDB). The current version is launched with JBoss 3.2.x as application server and the HSQL database [26].

The implementation of IMS LD business logic as a separate software unit (i.e. the CopperCope engine) with an API (Application Programming Interfaces) facilitates the development of IMS LD players by hiding the complexities of this standard. Thus, theCopperCore engine can be used when developing players that interpret IMS LD [82].

5.2.2 Reload LD Player

The Learning Design Player is based on and uses the Coppercore Learning Design Engine. When a Unit of Learning is created or retrieved from a repository, it is important that it can be 'previewed'. The Reload Learning Design Player (LDP) provides a graphical user interface for the CopperCore

LD runtime engine [109]. When the Unit of Learning is imported into the player, dummy users are automatically set up for each role defined in the LD. Any role can be 'played' by selecting that user from the list and clicking the play icon. All roles are loaded up as tabs in the browser pane. In this way, the user can view the behavior of the Unit of Learning for each role simultaneously. The Reload LD Player was developed at the University of Bolton.

5.2.3 Sled Player

The Sled LD player was built on the CopperCore engine, which validates a Learning Design package, in order to check if it conforms to the specification, and if not, indicates the problem areas. Thus a Learning Design package could be passed through CopperCore, validated and then passed on to a 'player', which would run the Learning Design, by instantiating the UoL, presenting the appropriate information to the user and calling the required tools. SLeD actually provides a more user-friendly graphical interface than the tool provided in CopperCore.

A Learning Design player was already included in the CopperCore package, but the rationale for this project was to separate out the player functionality from the underlying engine. Moreover, the focus of the JISC-funded project was to improve the ways in which the CopperCore Engine could be used by adopting the web services approach. So, communication between the player and engine used web services and additional end user tools such as search and conference systems were coded to allow web services [113].

The work succeeded in integrating two types of discussion forums and two separate types of search function into the SLeD player. The integration of these services demonstrated that both commercial and open systems could be called from the player, giving users a wide choice as to the actual implementation of any service they prefer [112]. The SLeD project (Service Based Learning Design Player) was developed by the UK Open University (OU) in collaboration with the Open University of the Netherlands (OUNL) [104].

5.3 Conclusions

Although the IMS LD specification has been available for certain years and much research and development has built up around it, for example, theTEN Competence project and the Reload project and several authoring tools have been developed, few practitioners have had practical

experience of it. Hazlewood [42], states that: "the understanding of the utility of the specification and its uptake is low. Factors contributing to this include lack of "practitioner friendly" tools and the inaccessibility of the specification to people who do not have a technical "background." The impression of the work with the Reload and Recourse LD editor throughout the duration of this thesis, is that the use of both Reload and Recourse Learning Design Editors demands from user to have technical and programming knowledge that the average educator do not usually have. Moreover the detection of possible errors during the development of a UoL is a difficult and time consuming process. These editors can be used mainly for editing UoLs since their use for creating one is complicated and not user friendly. From the experience of working with these tools, I agree with Miao that says that "the judgment of higher or lower level tool is based on how much knowledge about the LD the users of the tools should process. Normal teachers, who may have no knowledge about LD, need to be able to represent their pedagogic experience and instructional plans by using their conventional vocabularies such as course, lesson, presentation, discussion, voting, test and so on. It is a challenge to develop authoring tools for normal teachers. These tools should be based on high level language and can translate the learning designs represented by the high level language into the IMS-LD" [70].

Chapter 6
SLeD and Reload LD Player Interoperability

As it has been discussed in Chapter 4, IMS Learning Design basically aims to transform regular lesson plans into interoperable Units of Learning (UoL). This specification is able to use any pedagogical model to create a UoL, runnable and editable in an interoperable way. The interoperable UoL supposedly can be edited with any LD editor (like ReCourse, Reload or Collage LD Editor) and later, in runtime, "run" with any LD player, like CopperCore Player (like Reload LD Player and Sled).

This chapter seeks to test the interoperability of the IMSLD Specification implementations using two different LD Players, namely Sled and Reload LD Player.

6.1 Interoperability

Bryden [17], defines standards as "documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose".

E-learning interoperability standards can be organized as follows [24]:

- **Metadata:** learning content and catalog offerings must be labeled in a way that supports indexing, storage, search, and retrieval of learning objects by multiple tools across multiple repositories. Data used to describe and label the learning objects are called learning object metadata.

- **Content Packaging:** allows courses to be transported from one learning system to another. It includes both learning objects and information about how they are to be put together to form larger units of learning. Additionally, the rules for delivering content to a learner can also be specified.

- **Learner Profile:** information that are included in the learner profile can be personal data learning plans, learning history, accessibility requirements, certifications and degrees assessment of knowledge, and the status of participation.

- **Learner Registration:** allows learning delivery and administration components to know what offerings should be made available to learners, as well as providing information about learning participants to the delivery environment.

- **Content Communication:** allows components to share results at as low a level as an individual assessment question or a course grade or completion status.

6.2 Interoperability Test

Firstly, a number of UoLs, which were originally created using different LD editors, were downloaded from two sources, the DSpace repository at OUNL (name of the collection: "Example IMS-LD packages" located at http://dspace.ou.nl/handle/1820/257) and four adaptive UoLs were derived from the portal of the GRAPPLE research project (Generic Responsive Adaptive Personalized Learning Environment, http://www.grapple-project.org/), which was a three years project (2008-2011), aimed at delivering to learners a technology-enhanced learning (TEL) environment that would guide them through a life-long learning experience.

Afterwards, all twenty nine UoLs were uploaded both on the Sled and the Reload LD Player each in order to examine whether it would be successfully validated and if it was 'played' in satisfactory way both by the two players.

Additionally, a UoL that was created with LAMS and was exported as IMS LD Level A format (Fig. 6.1) was uploaded to both players. LAMS Version 2.2 according to (LAMS foundation) supposed to support exporting in IMS LD Level A format.
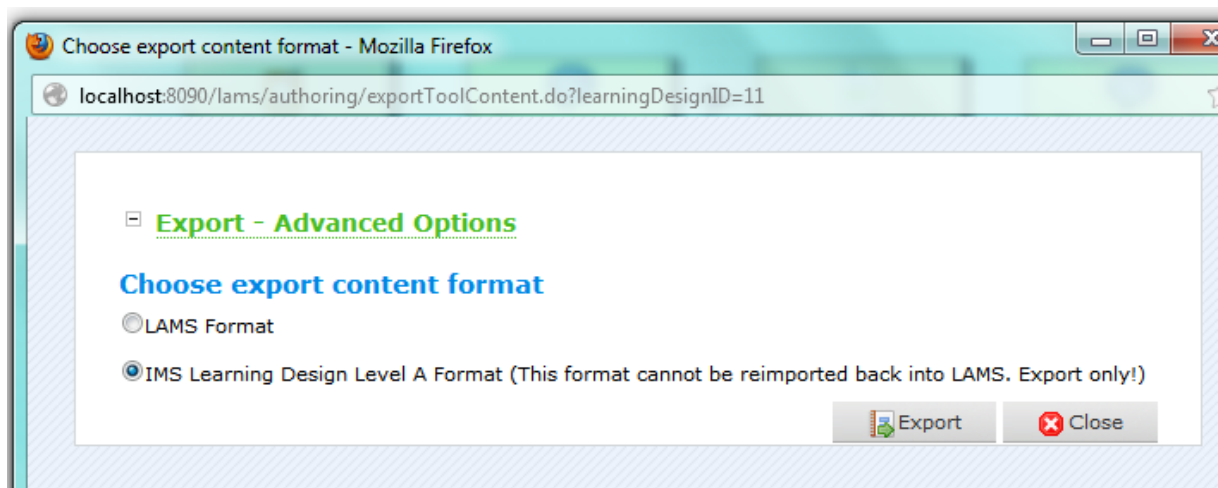

Figure 6.1: Exporting of the UoL in IMS LD Level A format from LAMS

Observations are reported in the table below:

- The first column of the table shows the title of the UoL,

- the second one shows its Level (A, B or C),

- the third one shows the URL from which the UoL was downloaded,

- the forth one shows the LD Editor which was used for the editing the UoL and

- at the last two columns the validation results are reported while using the Sled and the Reload LD Player respectively.

The Validation failure of a UoL is the most serious problem that can appear because in this case the UoL is not able to be uploaded in the LD player. Some other problems that concern the way a UoL is been 'played' are not that serious.

a/a	Name of UoL	Level	URL	Editor	Validation result	
					Sled	Reload LD Player
1	GeoQuiz 1	B	http://hdl.handle.net/1820/372		Successful	Successful
2	GeoQuiz 3	B	http://dspace.ou.nl/handle/1820/404		Successful	Successful
3	Assignment of learning activities based on self-assessment	B	http://hdl.handle.net/1820/1970	ReCourse	Successful	successful
4	CSCL Workshop 2009	B	http://hdl.handle.net/1820/2100		Successful	successful
5	Mythologies of Loss	B	http://hdl.handle.net/1820/1736	Reload	Successful	Successful
6	Using ICT inEducation	B	http://hdl.handle.net/1820/463	Collage	Successful	Successful
7	IMS-LD Modern Architecture: Skyscrapers and Residential Homes	A	http://hdl.handle.net/1820/2550		Successful	Successful
8	LearningOutcomesNegotiation	B	http://hdl.handle.net/1820/2243		Successful	Successful
9	ExamonPlayingViolin	B	http://hdl.handle.net/1820/2244		Successful	Successful
10	Debatetemplate UOL	A	http://hdl.handle.net/1820/1550	ReCourse	Successful	Successful
11	Δυναμική της Περιστροφής Στερεού Σώματος	B	http://hdl.handle.net/1820/1184	Collage	Successful	Successful
12	TestDrive	A	http://hdl.handle.net/1820/386		Successful	Successful
13	Privaatrecht	A	http://hdl.handle.net/1820/383	Reload	Successful	Successful
14	Character	A	http://hdl.handle.net/1820/377		Successful	Successful
15	Interactivebrainwriting	B	http://hdl.handle.net/1820/387		Successful	Successful
16	My ePortfolio	B	http://hdl.handle.net/1820/1971	ReCourse	Successful	Failed
17	Different Learning Path depending on Profile	B	http://hdl.handle.net/1820/1971	ReCourse	Successful	Failed
18	BajarImagenes de Internet usando ratón-N7	A	http://hdl.handle.net/1820/2101		Successful	Successful
19	Buscarruta con GoogleMaps-N3	A	http://hdl.handle.net/1820/2101		Successful	Successful
20	CLFriday	A	http://hdl.handle.net/1820/395		Successful	Successful
21	knowledge convergence script	C	http://hdl.handle.net/1820/1003		Failed	Failed
22	Chemical Hazard Storage emailexended	A	http://hdl.handle.net/1820/403		Successful	Successful
23	Tai Chi	A	http://hdl.handle.net/1820/396		Successful	Successful
24	Hello Notification	C	http://hdl.handle.net/1820/376		Successful	Successful

25	Modern Architecture: Skyscrapers and Residential Homes (Level B)	B	http://hdl.handle.net/1820/2551		Successful	Successful
26	PC Architecture	A	http://hdl.handle.net/1820/382		Successful	Successful
27	Students guide to blended learning environments	C	http://hdl.handle.net/1820/384		Successful	Successful
27	AdaptiveMentoring	B	http://www.grapple-project.org		Successful	Successful
27	AdaptiveAuthoring	B	http://www.grapple-project.org		Successful	Successful
28	AdaptiveAssesement	B	http://www.grapple-project.org		Successful	Successful
29	AdaptiveContent	B	http://www.grapple-project.org		Successful	Successful
30	ΔK_25Ιουλ_v2_imsld	A	Confidential Deliverable	LAMS	Fail	Fail

6.3   Results

6.3.1   Validation problems

In this section, the results of the interoperability test between the two players are described.

As regards the "Test Drive" LD Package, at first it could not be imported at any of the two players. The error message by Sled Player was that the *imsmanifest.xml* file was missing from the Package. The problem was occurred due to the fact that the Package file was zipped twice. After it was properly unzipped it was validated successful by both Reload and Sled Player (Fig. 6.2). Thus, in this case there wasn't an actual interoperability problem.

Time	Level	Message
0	0	Validation started.
0	0	step 1 - Analysing package (C:\Users\ouc\programs\ccrt_tenc\data\upload\UOL1_testdrive.zip).
114	0	step 2 - validating the manifest.
423	0	step 3 - validating global content.
427	0	step 4 - checking if all files in package are referenced.
427	1	File (publi_zip\UOL1_testdrive2.zip) is included in package, but is never referenced
427	1	File (IMS_LD_Level_A_reusables.xsd) is included in package, but is never referenced
427	1	File (IMS_LD_Level_A_emaildata.xsd) is included in package, but is never referenced
427	1	File (publi_zip\UOL1_testdrive1.zip) is included in package, but is never referenced
427	1	File (ims_xml.xsd) is included in package, but is never referenced
427	0	Validation passed successfully.
431	0	Semantic validation of manifest started
644	0	Successfully build component model
644	0	Semantic validation was succcessful
644	0	Validation manifest succeeded

Figure 6.2: Validation successful for the "Test Drive" Package by Sled player

The most serious problem detected is that three of the tested Learning Design Packages: "My ePortfolio", "Different Learning Path depending on Profile" and "knowledge convergence script" could not be imported in Reload LD Player. One of these Packages, "knowledge convergence script", was not able to be uploaded either in Sled Player (Fig. 6.3). The reason for the validation failure of this Package is the fact that no resources were included in it. In the package there was only the *imsmanifest.xml* file. Thus, this is not an interoperability problem.

Time	Level	Message
0	0	Validation started.
0	0	step 1 - Analysing package (C:\ccrt\data\upload\coordination.zip).
32	0	step 2 - validating the manifest.
498	2	Resource information-head.xml not found in package.
498	2	Resource unfold.css not found in package.
498	2	One or more resource validation errors occured
498	2	Resource instruction.xml not found in package.
498	2	Resource unfold.css not found in package.
498	2	One or more resource validation errors occured
498	2	Resource form-for-report1.xml not found in package.
498	2	Resource unfold.css not found in package.
498	2	One or more resource validation errors occured
498	2	Resource form-for-report2.xml not found in package.

Time	Level	Message
545	2	One or more resource validation errors occured
545	2	Resource form-for-final-report2.xml not found in package.
545	2	Resource unfold.css not found in package.
545	2	One or more resource validation errors occured
545	2	Resource form-for-final-report3.xml not found in package.
545	2	Resource unfold.css not found in package.
545	2	One or more resource validation errors occured
545	0	step 3 - validating global content.
545	0	step 4 - checking if all files in package are referenced.
545	0	Validation failed.

Figure 6.3: Validation failure for the "knowledge convergence script" Package ("coordination.zip" file) by Sled player

The error message shown in figure 6.4 was appeared by Reload Player.
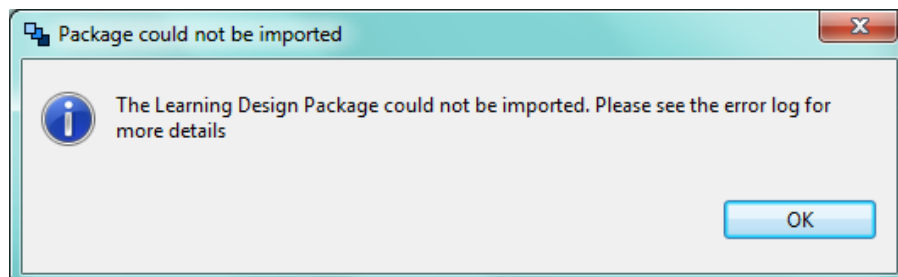
Figure 6.4: Error message from Reload LD Player

The reason for validation failure was detected in error log file which contains more details: "*The matching wildcard is strict, but no declaration can be found for element 'ldauthor:root'.*"

A serious interoperability problem was occurred with UoL*s* "My ePortfolio" and "Different Learning Path depending on Profile", since were successfully validated by Sled but not be Reload player. The error according to error log file of Reload player is: *"javax.naming.NamingException: Could not dereference object"*. This seems to be a technical problem and thus in this case the interoperability problem is serious.

Furthermore, the validation of the UoL "ΔK_25Ιουλ_v2_imsld" was failed by both players. This is a proof that LAMS is not able to export UoL as IMS LD Packages.

Time	Level	Message
0	0	Validation started.
0	0	step 1 - Analysing package (C:\ccrt\data\upload\ΔK_25Ιουλ_v2_imsld.zip).
250	0	step 2 - validating the manifest.
1578	3	org.xml.sax.SAXParseException: cvc-complex-type.2.4.a: Invalid content was found starting with element 'lams:firstActivityID'. One of '{"http://www.imsglobal.org/xsd/imsld_v1p0":learning-objectives, "http://www.imsglobal.org/xsd/imsld_v1p0":prerequisites, "http://www.imsglobal.org/xsd/imsld_v1p0":components}' is expected.
1578	0	Validation failed.

Figure 6.5: Validation failure for the "ΔK_25Ιουλ_v2_imsld" Package by Sled player

6.3.2 Services problems

The services of chat and forum are used in a number of LD Packages. When such a UoL is played by Sled Player and those services are activated, then a window is automatically launched and every participant can post the comment he wants. In contrast, when the same UoL is played by Reload Player, the window does not open.

Figures 6.6 and 6.7, show the function of chat and forum services respectively, (the same UoL, named "Buscarruta con GoogleMaps-N3" http://hdl.handle.net/1820/2101, in both cases) while playing with Sled Player. Picture 6.8 shows the malfunction of those services of the same UoL while playing with Reload LD Player.
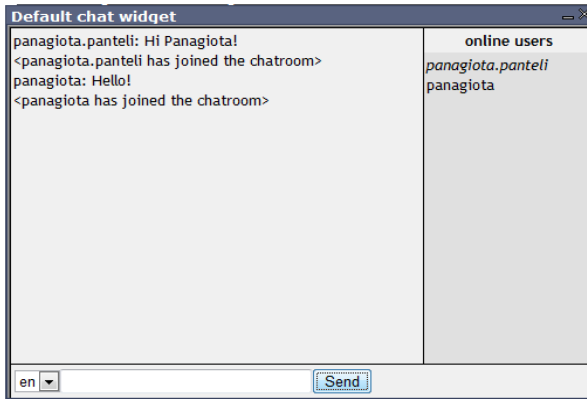
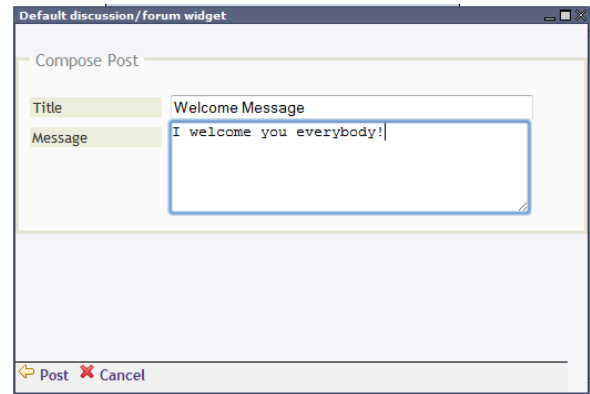**Figure 6.6:** Chat service in UoL "Buscarruta con GoogleMaps-N3" with Sled Player

Figure 6.7: Forum service in UoL "Buscarruta con GoogleMaps-N3" with Sled Player

Figure 6.8: Chat service malfunction in "Buscarruta con GoogleMaps-N3" with Reload LD Player

Additionally, the Reload LD Player has a problem with Packages that contain activities, which demand from the user to make a choice from a drop down list or to click a button or to add text. In this case, the drop down list, the button or the text box is not appeared.
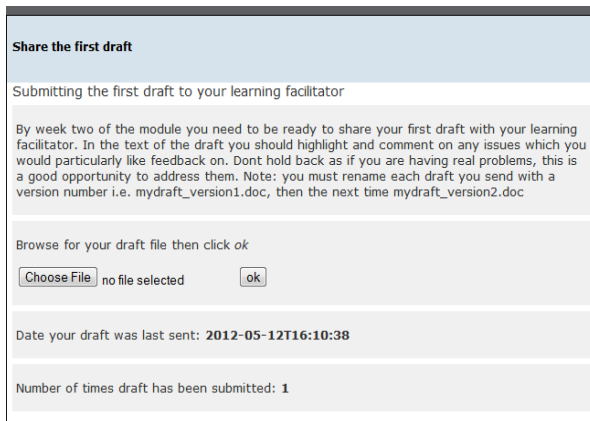
Figure 6.9: The UoL "Learning Outcomes Negotiation" in Sled Player
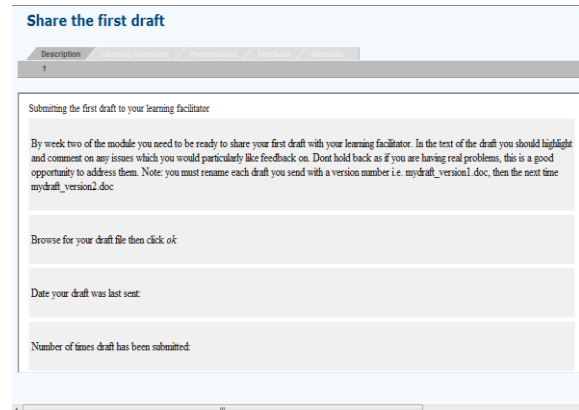
Figure 6.10: The UoL "Learning Outcomes Negotiation" in Sled Player
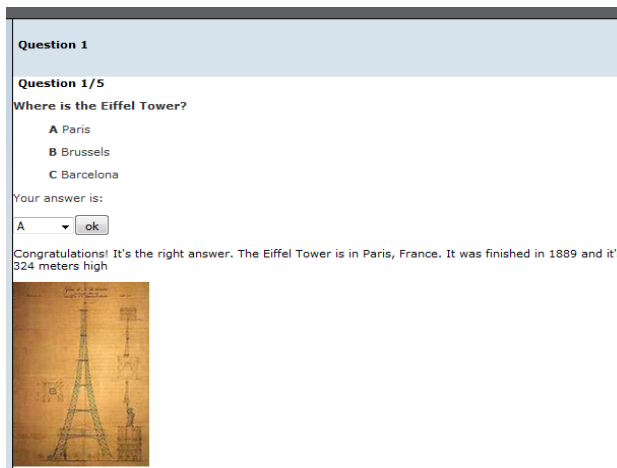
Figure 6.11: The UoL "GeoQuiz1" in Sled Player
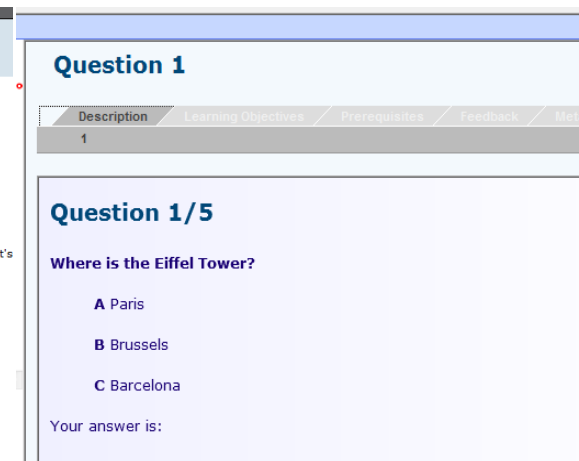
Figure 6.12: The UoL "GeoQuiz1" in Reload LD Player
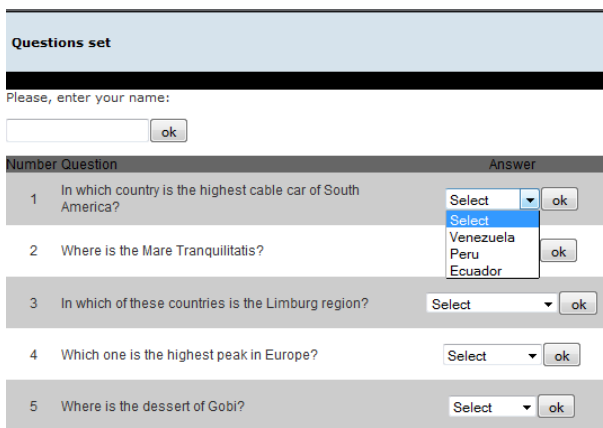
Figure 6.13: The UoL "GeoQuiz3" in Sled Player
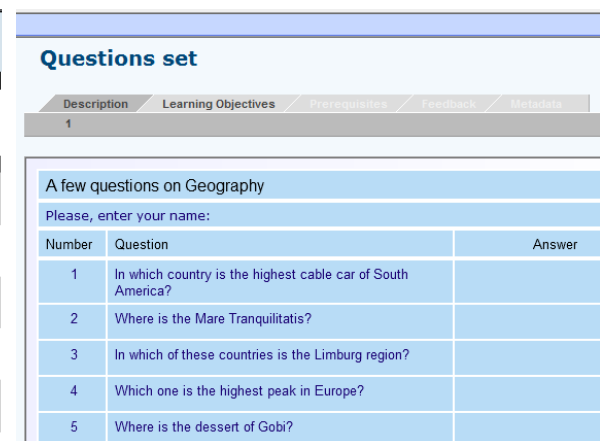
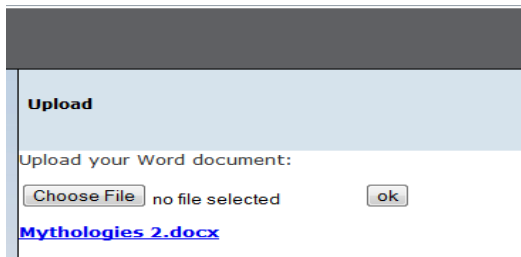**Figure 6.14:** The UoL "GeoQuiz3" in Reload LD Player

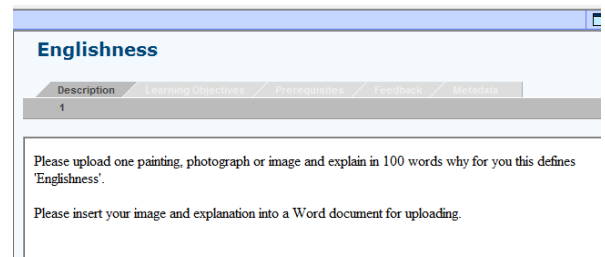**Figure 6.15:** The UoL "Mythologies of Loss" in Sled Player

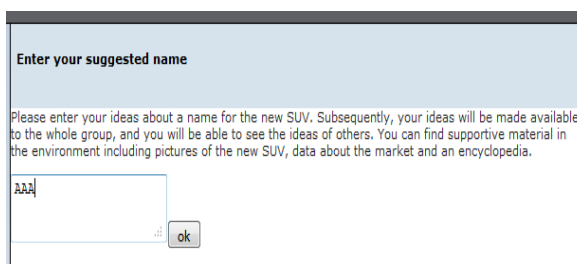**Figure 6.16:** The UoL "Mythologies of Loss" in Reload LD Player
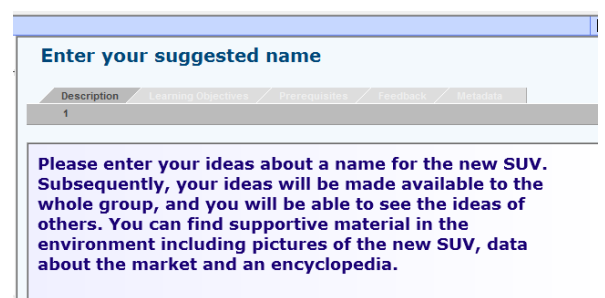

Figure 6.17: The UoL "Brain Writing" in Sled Player

Figure 6.18: The UoL "Brain Writing" in Reload LD Player
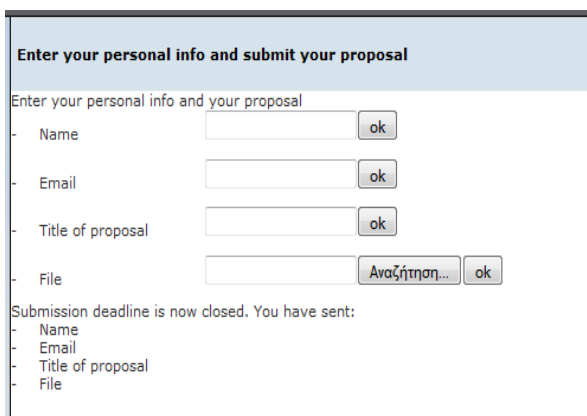

Figure 6.19: The UoL "Adaptive Mentoring" in Sled Player
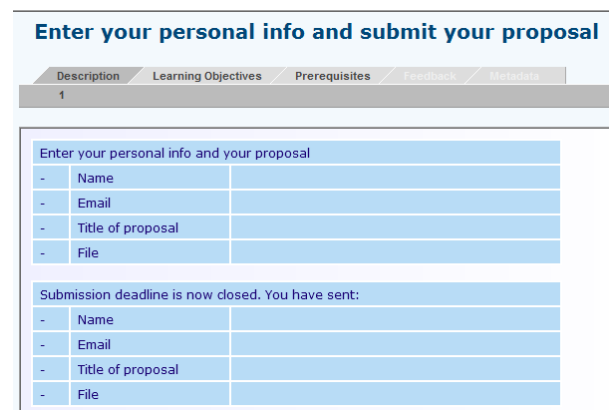

Figure 6.20: The UoL "Adaptive Mentoring" in Reload LD Player

In Sled Player a number of adapters were developed such as a search adapter and a forum adapter for the corresponding services, probably in order to support the use of Web 2.0 services in IMS LD implementation. Each adapter is a software component encapsulating a single service implementation [110. Those services are supported by Sled Player. On the contrary, such adapters

were not developed in Reload Player, since is an older Player. This is way the user cannot use the chat service or the forum service while using the RELOAD LD player.

With regards, to the problems depicted in the figures 6.9 and 6.16: It seems that the RELOAD LD player cannot 'recognise' XML files in the format imsldcontent.

6.3.3 Other problems

Reload LD Player has some more problems with certain LD Packages. In contrast, these problems are absent in Sled Player.

a) Activity "Resources Against" of LD Package "Debate Template", functions efficiently with Sled Player, but using Reload LD Player an error message appears: "The XML Page cannot be displayed".
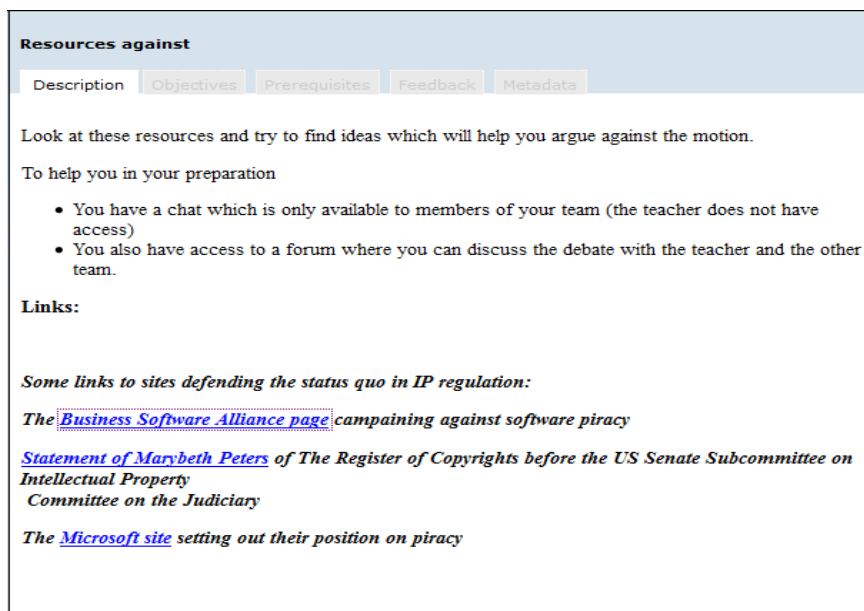

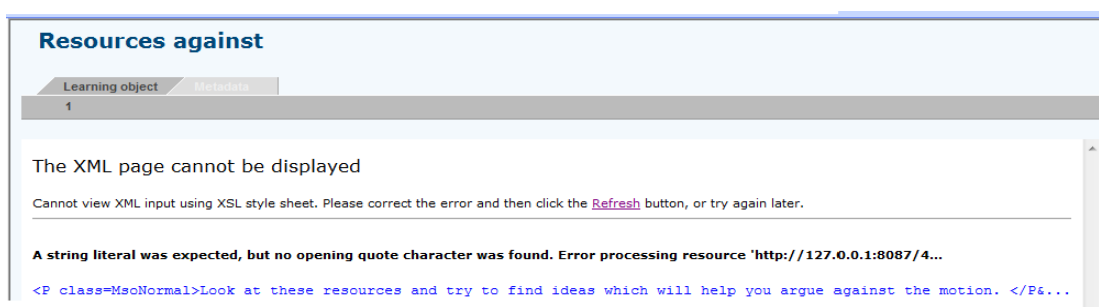**Figure 6.21:** Activity "Resources Against" of LD Package "Debate Template" with Sled Player

Figure 6.22: Activity "Resources Against" of LD Package "Debate Template" with Reload LD Player

b) The Role "Chair" of LD Package "Exam on Playing violin", functions efficiently with Sled Player, but using Reload LD Player an error message appeared. The error message is shown in picture 6.20. The same problem occurred with LD Packages: "ICT in Education" and "Debate Template" too.

A problem occured

You may need to refresh the viewer

EJBException:; nested exception is: javax.ejb.EJBException: null; CausedByException is: null; CausedByException is: org.xml.sax.SAXException: FWK005 parse may not be called while parsing.

Figure 6.23: Error message of Reload LD Player

c) The LD Package "Exam of Playing violin", functions properly with Sled Player. However using Reload LD Player the code of imsmanifest.xml file appears on the screen.
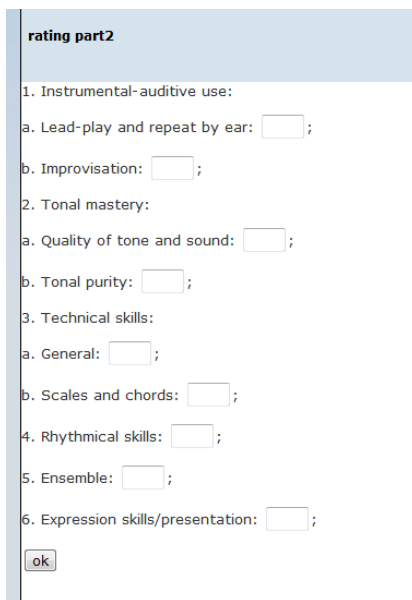

rating part2

1. Instrumental-auditive use:

a. Lead-play and repeat by ear: ___ ;

b. Improvisation: ___ ;

2. Tonal mastery:

a. Quality of tone and sound: ___ ;

b. Tonal purity: ___ ;

3. Technical skills:

a. General: ___ ;

b. Scales and chords: ___ ;

4. Rhythmical skills: ___ ;

5. Ensemble: ___ ;

6. Expression skills/presentation: ___ ;

[ok]

rating part1

| Description | Learning Objectives | Prerequisites | Feedback | Metadata |

1

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<assessmentItem xmlns="http://www.imsglobal.org/xsd/imsqti_v2p0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.imsglobal.org/xsd/imsqti_v2p0
  imsqti_v2p0.xsd" identifier="rating11" title="rater1 rates part1"
  adaptive="false" timeDependent="false">
  <responseDeclaration identifier="r-lead-play" cardinality="single"
    baseType="string">
    <mapping defaultValue="0">
      <mapEntry mapKey="1" mappedValue="1" />
      <mapEntry mapKey="2" mappedValue="2" />

      <mapEntry mapKey="4" mappedValue="4" />
      <mapEntry mapKey="5" mappedValue="5" />
      <mapEntry mapKey="6" mappedValue="6" />
      <mapEntry mapKey="7" mappedValue="7" />
      <mapEntry mapKey="8" mappedValue="8" />
      <mapEntry mapKey="9" mappedValue="9" />
      <mapEntry mapKey="10" mappedValue="10" />
    </mapping>
  </responseDeclaration>
```

Figure 6.24: The UoL "Exam on Playing violin" in Sled Player

Figure 6.25: The UoL "Exam on Playing violin" in Reload LD Player

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6.4   Conclusions

Taking into consideration the interoperability tests above come to conclusion that Sled LD Player functions more efficiently in the most cases. A very low percentage, just two of a total of twenty nine, tested Packages failed the validation with Reload Player but passed the validation successfully with Sled Player. Although the percentage of interoperability is high, in not 100% as was expected. Sled Player can 'play' without a problem the most LD Packages while Reload Player is not. Sled Player supports successfully services of chat, forum and search while Reload Player is not. In conclusion, Sled Player is more reliable and that is the reason was chosen for 'playing' IMS LD compatible learning scenarios described at Chapter 8.

Chapter 7
Web 2.0

7.1 What is Web 2.0

Anderson [05] argues that, the best way to define Web 2.0 is "to make a reference to a group of technologies which have become deeply associated with the term: blogs, wikis, podcasts, RSS feeds etc., which facilitate a more socially connected Web where everyone is able to add to and edit the information space".

People thought about how the World Wide Web was changing and found some key differences between the new sites and the older ones: a new way of designing participation, hosting services and web based communities, promoting creativity and information sharing [11].

Some key differences between the new internet (web 1.0) and the older one (web 2.0) include: enhanced user participation, hosting services (cloud) and web based communities (communities of interest, online learning communities etc), promoting creativity and information sharing [11].

7.2 Web 2.0 Characteristics

O' Reilly [78] states several principles concerning Web 2.0, which include:

- **Harnessing the collective intelligence:** information is collected from lots of people rather than a few experts (for example, Amazon Mechanical Turk, (https://www.mturk.com/mturk/welcome)

- **End of the software release cycle:** new functionality is released with high frequency (Flickr improving new builds up to every half hour).

- **Lightweight programming models:** consumers are using simple development environments that are easy to be re-used (Google Maps).

- **Software above the level of a single device:** lots of devices are working together with the web, such as the combination of iTunes and iPods.

In addition, Anderson [05] describes six big ideas behind Web 2.0

- **Individual production and User Generated Content (UGC):** the users can perform a number of activities with a few clicks on the mouse such as upload a video or photo from their digital camera and make them available to their friends or to other users in general. Also some users are setting up and writing blogs and working together to create information through the use of wikis. USG refers to the ease of creating services or content. Examples of Web services that promote UGC are: MySpace, Blogger and You Tube.

- **Harnessing the power of the crowd:** it refers to the collective intelligence that can be controlled from large groups of people. Examples of Web services that promote collective intelligence are: Digg and Wikipedia.

- **Architecture of participation:** is based on the ideas that Web services must be easy to use and must be organized in such a way that more people can use them. For example Google Search.

- **Openness:** it refers to the philosophy of the free sharing of information and resources among users, such as inserting a You Tube video in a blog.

According to Peachey [84], Web 2.0 have lots to offer to teachers. Web 2.0 enables:

- **Socialisation:** the students can use the language and skills that are learning to build networks and develop relationships with people in real life.

- **Collaboration:** they can work together with others to construct and share knowledge

- **Creativity:** they can create genuine products, in a wide range and combination of media to high standards that will have a real audience.
- **Authenticity:** the tasks and activities they performed collaborative in authentic context, in the sense that they are closed to their everyday experience, aspirations and needs as well as motivating.
- **Sharing:** they can share what they create and learn from each other.

7.3 User Generated Content and Social Media

As discussed in the previous paragraph, the term Web 2.0 is closely related with the User Generated Content (UGC). According to Interacting Advertising Bureau [49], UGC refers to "any material created and uploaded to the internet by non-media professionals", for example, a video uploaded to YouTube, as well as photos left on Facebook and comments left on Twitter. It is one of the fastest growing forms of content on the internet and it is altering how audiences interact with the Internet and how advertisers may reach those audiences [49].

Today, review sites constitute one of the more relevant types of UGC for consumer brand names. This can help the consumers to share their experiences about specific brand names, thus helping others to make more informed purchasing decisions. Most of the sites are grouped by category, well moderated, as well as can be brand friendly to the company [49].

UGC is also connected with Social Media. Bruns and Bahnisch [15], define Social Media as "websites which build on Web 2.0 technologies to provide space for in-depth social interaction, community formation and the tackling of collaborative projects".
The above definition includes social network sites but also social media sites. Such social media sites are [15]:
- Wikipedia (managing of knowledge)
- Flickr and YouTube (sharing of media) and
- Yelp or TripAdvisor (advising the community and self-help)

Furthermore, it excludes websites which build on Web 2.0 technologies for example:

- Many travel and product review websites which offer an option to add comment but fail to influence the knowledge of current communities.
- Many news media websites which provide the ability to add comments to news articles but offer no space for meaningful longer-term interaction amongst authors and commenters.

7.4 Web 2.0 Tools

According to [05], there are a number of Web-based tools, services and applications that demonstrate the foundations of the Web 2.0 concept, and are already being used to a certain extent in education.

Some of these Web 2.0 tools are: blogs, wikis, chats, forums, podcasts, vodcasts, social bookmarking, microblogging etc. Many of these applications of Web technology that having been in use for a number of years now are relatively mature, although new features and capabilities are being added on a regular basis [05].

7.4.1 Blog

The term blog or web-blog refers to a simple webpage consisting of brief paragraphs of opinion, information, personal diary entries or links that are called posts arranged by date with the most recent first, in the style of an online journal [29]. Furthermore, it is possible to subscribe in order to receive news, via email or through RSS readers. Also visitors can add comments below a blog entry and usually include the source of information, thus validating it [11]. RSS (Really Simple Syndication) is a format for syndicating news and the content of news-like sites like, as well as personal weblogs [86].

Concerning education Bartolome [11] states that blogs are used:
- By teachers as an easy way to produce dynamic learning environments without previous knowledge of html.
- By students as an alternative digital portfolio and
- As a support for collaborative work.

For example blogger.com and wordpress.org were two of the earliest websites designed specifically for personal Blogging and each one have accumulated millions of members [41]. The table below shows some of the well-known or education based blogs, software and blog search services [05]:

Educational Based Blogs	Software	Blog Search Services
http://radar.oreilly.com/	http://wordpress.org/	http://technorati.com
http://www.techcrunch.com/	http://sixapart.com/typepad/	http://www.gnosh.org
http://www.instapundit.com	http://www.blogger.com/start	http://blogsearch.google.com/
http://blogs.warwick.ac.uk/	http://radio.userland.com/	http://www.weblogs.com/about.html

7.4.2 Wiki

According to Ebersbach et. al. [32], a wiki is a webpage or a set of webpages that can be easily edited by anyone who is allowed to have access. Graeme [36], states that "A wiki is essentially a website constructed in such a way as to allow users to change content on the site". Wiki pages contain an edit button which is displayed on the screen and enables the user to click on this to access an online editing tool, to change or even delete the contents of the page in question. Hypertext-style linking between pages is simple is used to create a navigable set of pages [05].

As regards education wikis are used in several ways [11]:
- To support collaborative work, substituting old .doc or .pdf documents
- To produce a course or study corpus (a large collection of texts) in cooperation with tutors and learners.
- To distribute information to learners, thus facilitating the updating of materials by the tutor.

One of the most well-known wikis is Wikipedia, the free internet encyclopedia. According to Terdiman [101], Wikipedia is about as good a source of accurate information as Britannica. Below are some examples of wikis used in education:
- The EduTechWiki, about Educational Technology
  http://edutechwiki.unige.ch/en/Main_Page
- The Classroom 2.0 wikis (i.e. ideas for leeson plans)
  http://wiki.classroom20.com/

- The Encyclopedia of Educational Technology

  http://eet.sdsu.edu/eetwiki/index.php/Main_Page

7.4.3 Chat and Chat Rooms

Online chat may refer to any kind of communication over the internet, that offers a real-time direct transmission of text-based messages [117] and it involves communication by sending text messages to people in the same chat-room in real-time [115], Chat room, no date). Chat rooms can be either public (any website visitor can enter the chat room) or private (only website visitors that are invited can join the chat room.

In part, chat rooms have become one of the fastest growing segments of the Internet, because they may provide an entertaining and interactive way to make friends. Concerning education, students can participate in a collaborative internet based community by sharing resources, knowledge production, creative inquiry and active management [41].

A level of anonymity might be provided to participants in the chat room via a "handle" or "nickname" (such as Samboy34 or Mary123). Regarding education, teachers should plan and prepare their lessons accordingly due to the anonymity of most chat rooms. Students should be supervised or moderated by the teacher during chatting. Access should be given only to educational based chat rooms. Furthermore, the teacher should verify up front what the topics will be discussed and also have reviewed the site's privacy policy as well as, terms and conditions before considering the chat room for educational attempts [41].

Some examples of professional, personal, community and educational chat rooms can be:
- http://www.flora.org/homeschool-ca/support.html#chat
- http://homeschoolcentral.com/
- http://www.greekchat.com/
- http://www.about.com/

7.4.4 Forum

One of the oldest social computing tools is forum. According to Kreitzberg [62] a forum is "a community in which people conduct many conversations by posting comments online". There is a main difference between a forum and a blog. A forum is best described as a group of related blog posts and answers, usually set up by an organization or company to have specific range of predefined topic areas. On the other side, a blog is often used by only one person to comment on any specific topic that the user is interested in on any given day or time [42].

Some examples of forums online are stated below:
- http://eclass.ouc.ac.cy
- http://www.bizymoms.com/discus
- http://www.customerservicemanager.com/community/
- http://www.webmasterworld.com

7.4.5 Podcast and Vodcast

At the beginning podcasts were called 'audio blogs'. Felix and Stolarz [34] state that: "podcasts have their roots in efforts to add audio streams to early blogs". According to [05], podcasts are audio recordings, usually in MP3 format of talks, interviews and lectures, which can be played either on a desktop computer or on a wide range of mobile devices that are (additionally or exclusively) MP3 players. For example, iPods, PDAs, smart phones etc. [40]. Vodcasts are video podcasts, i.e. video clips that can be played on a PC, or on a suitable manual player, for example the Apple iPod [05].

In education podcasts can be used to in online courses as a method of delivering the course content orally to the students whenever possible. Another important use is when a teacher finds a vodcast for students to listen and watch. In addition, podcasts can be used in distance learning education [40]. For example, the United States Distance Learning Association (http://www.usdla.org/podcasts/).

The steps in the construction of a podcast are stated below [05]:
- Creating an MP3 format audio file(using a voice recorder or similar device).

- Uploading the file to host server.
- Using of RSS, thus making the world aware of its existence.

Some examples of well-known podcasting sites are [05]:
- http://www.apple.com/itunes/store/podcasts.html
- http://www.ourmedia.org
- http://juicereceiver.sourceforge.net/index.php
- http://www.impala.ac.uk/

7.4.6 Social Bookmarking

Social bookmarking is a technique that allows the users to store, classify, organize, describe and share links of interesting websites (including weblogs, wikis etc.). Additionally, it is possible to share favorite links with other users who like to attempt through blogs or RSS technology [33].

There are different types of social bookmarking systems. Some of them are focusing on collecting web sites such as [33]:
- http://delicious.com/
- http://www.diigo.com/
- http://www.mister-wong.com/
- http://blinklist.com/

Others are focusing on collecting news for example http://digg.com/, while some others on pictures, like http://www.flickr.com/ or even on bibliographical references like, http://www.citeulike.org/.

7.4.7 Microblogging

Microblogging is defined in Wikipedia as "a form of blogging that allows users to write brief text updates (usually 140 characters) and publish them, either to be viewed by anyone or by a restricted group which can be chosen by the user" [116].

Microblogging allows people to publish short messages on the web about what they are currently doing. Additionally, it allows people to publish brief text updates, using a large number of various communication channels such as text messages from cell phones, instant messaging, email and the Web [83].

Microblogging enables the users to broadcast and share information about their activities, opinions and status. Activities, Furthermore, it provides topics concerning daily life, current events, news stories and other interests. Additionally, microblogging tools facilitate the sharing status of messaging (either publicity or within a social network) [51].

Some examples of microblogging services are:
- http://twitter.com
- http://seesmic.com
- https://www.tumblr.com/

7.5 Widgets

World Wide Web Consortium [20], defines widgets as "interactive single purpose applications for displaying and/or updating local data or data on the Web, packaged in a way to allow a single download and installation on a user's machine or mobile device". Widgets are designed for a single exact function as well as quick instant action to Web 2.0 services. Some examples of widgets are clocks, weather forecasts, news readers and photo albums [54].

Widgets are similar to web pages. There are widget engines which act like web browsers. A widget engine is a special runtime environment within which widgets are executed [54].

Three groups of widgets can be classified [54]:
- Desktop widgets: can be run from the computer's desktop, for example a small application on desktop such as Weather.com for displaying the temperature of the area. Another example are the handy gadgets. The gadget feature was

introduced with Vista and has been improved in Windows 7, such as Currency, Feed Headlines, Weather, and Calendar [50].

- Web widgets: are reusable components of a web site which can be embedded in other web pages. Examples are the Google advertisements.

- Mobile widgets: are made or designed for access on mobile devices. For example, Some examples of mobile widgets are: Cheap Gas, Live Sports Scores, Traffic, Twitter, Wikipedia [98].

Chapter 8
Learning Scenarios

8.1 Learning Scenario "Powers"

8.1.1 Tools

For this UoLs, were used the tools listed below:

1. ReCourse Learning Design Editor, IMS-LD compliant (Level C), used to edit the UoL and
2. Sled 3, a IMS-LD runtime Engine which contains:
   a. CCRT (CopperCore Runtime), LearningDesignPlayer
   b. WookieWidget Server (http://getwookie.org)

8.1.2   Lesson Plan

Title: Powers

Roles: Learner, Teacher

Learning Design Level: B (conditions apply with respect to the student previous knowledge level)

Learning outcome: After completing this unit students will be able to calculate the arithmetic value of a) powers and b) numericalrepresentations that contain powers. For "Level 1" powers have base and exponent both natural numbers, for "Level 2" powers have base natural and exponent integer number and for "Level 3" powers have base rational and exponent integer number. This unit aims every student to improve his/her skills at the Level he/she choose and if possible to move to higher Level until the Level 3.

Learning Flow:

The student logs in and selects this particular course from the list of available courses (i.e. courses in which he/she is enrolled).

1.   **Level Choice**

At the first part of the UoL, the student has the opportunity to choose one of three levels. A short description of the content of every level is given. The first level is the easiest one. The second level is more difficult and the third, which is the last level, is the most difficult of all. The student can have a look at the assignment of every level and then selects a level according to his/her previous knowledge. The system shows the review of this Level and an assignment (in the form of word document that contains appropriate exercises) which the student has to complete.

1.1 The subject of "Level 1" is "Powers with base and exponent both natural numbers".

1.2 The subject of "Level 2" is "Powers with base rational number and exponent natural number".

1.3 The subject of "Level 3" is "Powers with base rational number and exponent integer number".

In every level there is a review and a test. In case student passes the test successfully, the next (more difficult level) is presented. Otherwise the same level is repeated. The goal for student is to complete successfully all levels up to level 3. As soon as he passes the level 3 an Advanced Assignment is presented.

2. Assignment completion

At this part of the UoLthe student completes his/her Assignment. During the completion of the Assignment, the student can have a look at the short review, at any moment he/she needs it. Moreover, the student can ask his/her questions in the Chat room (that is being automatically launched by the system) in order to get help from the teacher or his/her classmates. The role of the teacher at this point is to guide the discussion so that students are brought to the right conclusions. Once the student completes his Assignment, he submits it to the teacher. The teacher makes corrections on the Assignments submitted and grades them.

3. Feedback

At the last part of the UoL , the student can look at the corrections the teacher have made on his Assignment and read his comments and suggestions. The teacher and the students discuss the Assignments results in an online forum (the system launches the forum automatically).
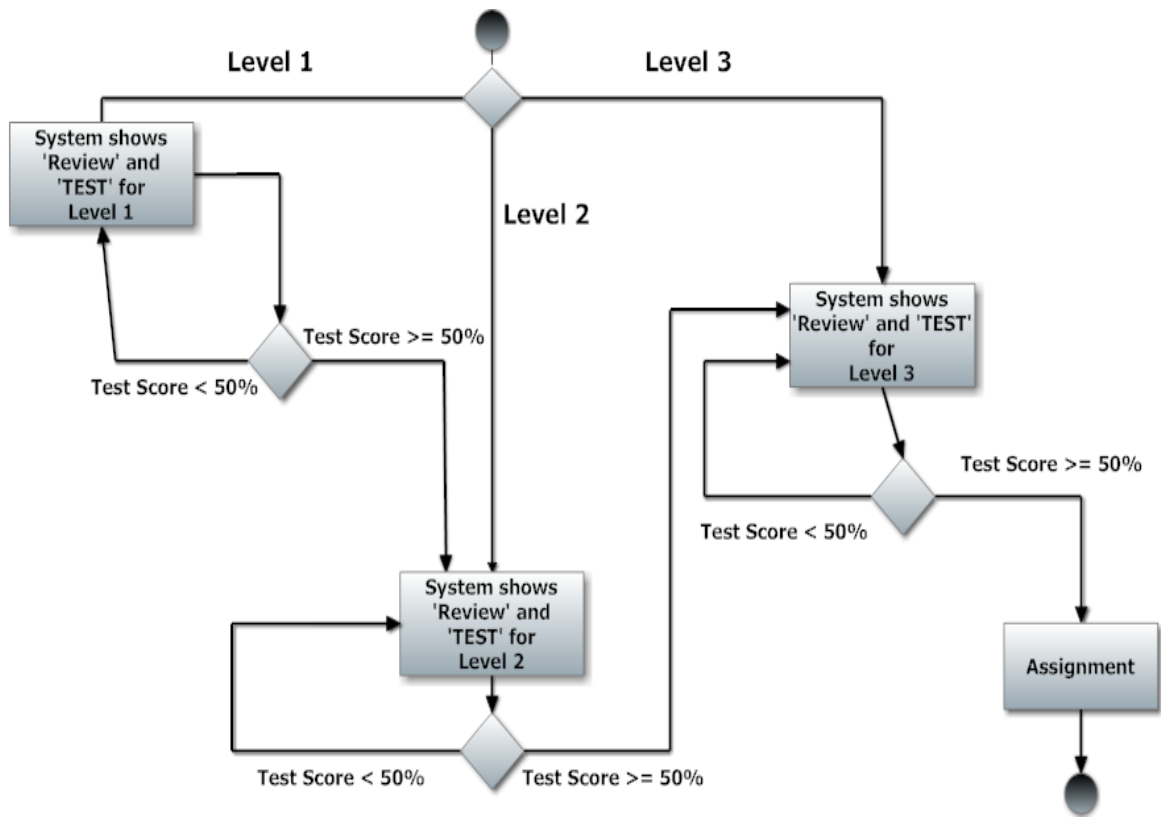
Diagram 8.1: A UML of the Learning Flow of the Scenario "Powers".

8.2   Learning Scenario "Surface Area"

8.2.1   Tools

For the creation of this UoL have been used the same tools as the previous UoL.

8.2.2   Lesson Plan

Title: Surface Area

Roles: Learner, Teacher

Learning Design Level: B (conditions apply with respect to the student previous knowledge level)

Learning outcome: After completing this unit, students will be able to understand the formulas give the surface area of particular plane shapes and apply these formulas in order to solve mathematical problems. "Level 1" contains the formulas for area of square, rectangle and parallelogram. "Level 2" contains the formula of area of triangle. This unit aims every student to improve his/her skills at the Level he/she choose and if possible to move to higher Level. Eventually every student will get suggestions from the teacher about the material he/she need to study in order to improve himself.

Learning Flow:

The student logs in and selects this particular course from the list of available courses (i.e. courses in which he/she is enrolled).

1.   **Previous Knowledge Quiz**

At the first part of the UoL, student completes a short quiz of five questions about area of square, rectangle and parallelogram. After submitting all the answers system gives feedback to the student and his results.

2. Studding material and Activities

The system shows the appropriate material every student has to study according to his/her quiz results.

a. "Level 1" If student answered correctly two or less questions of the previous quiz, this is an indication that the student needs to study more about the formulas of area of square, rectangle and parallelogram and get some practice in order to be able to continue with the study of area of triangle. The system shows the appropriate material and test for practice.

b. "Level 2" If student answered correctly three or more questions of the previous quiz, this is an indication that the student has the prerequisite knowledge of formulas of area of square, rectangle and parallelogram and can easily understand the formula of area of triangle. The system shows the appropriate material and test for practice.

At this part of the UoL the "Distance Calculation" (Fig. 8.1) widget is used. This helps students to learn how to use maps, construct quadrilaterals and calculate their surface area.   Teacher can help students by answering their questions and guide them using the forum and chat that automatically be launched by the system.
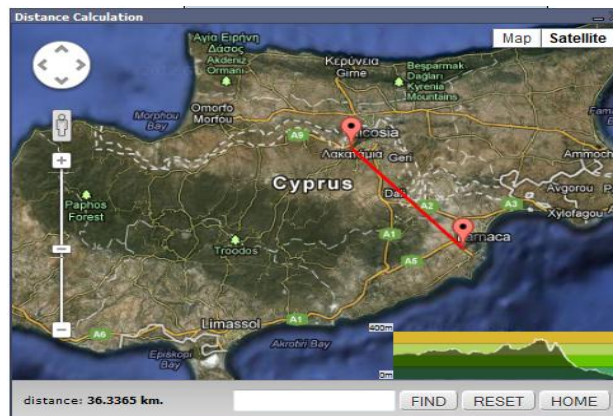
Figure 8.1: "Distance Calculation" widget

3. Questionnaire

At the end student can practice through a questioner. The questioner is appropriate for every level. For level 1 is easy and for level 2 is more difficult. After the submission of every answer,

student gets automatically the suitable feedback in order to know if his answer was correct and if not to be able to understand his mistake and which the correct answer is.

At the end, "Vote" widget is used to be able for students to grade the UoL.
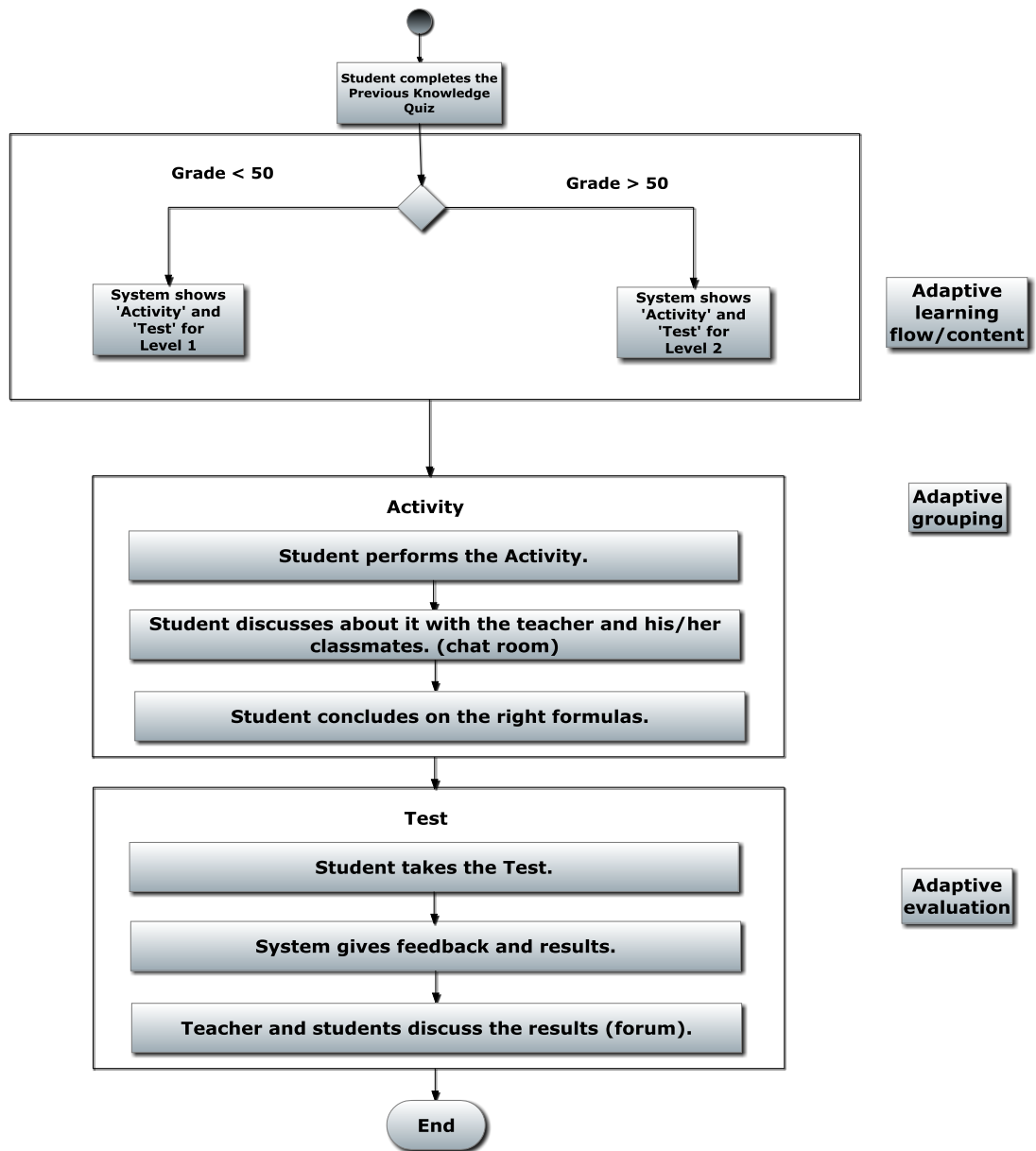
Diagram 8.3: A UML Diagram of the Learning Flow of the Scenario "Surface Area"
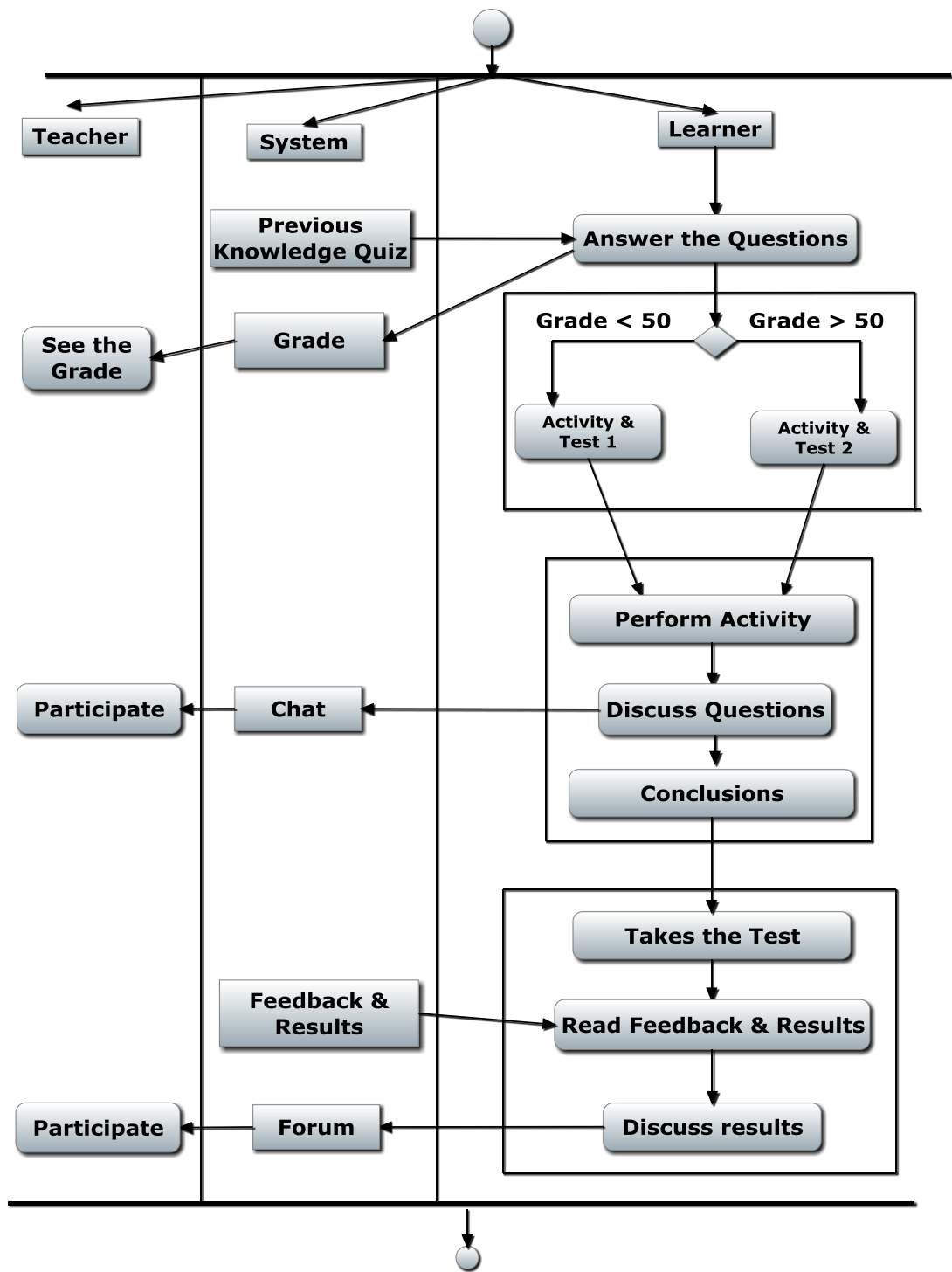
Diagram 8.4: A UML Diagram of the Learning Flow of the Scenario "Surface Area"

8.3 Learning Scenario "Line y=ax+b"

8.3.1 Tools

This UoL was created with the CourseLab Editor. CourseLab is an easy-to-use, e-learning authoring tool that offers programming-free WYSIWYG environment for creating interactive e-learning content which can be published on the Internet, Learning Management Systems (LMS), CD-ROMS and other devices. CourseLab Editor in contrary with ReCourse and Reload Editor is a user friendly authoring tool. Educators who have just some basic computer skills will be able to use it and create UoL in short time and without much trouble. E-learning course that published by CourseLab may be conformant with one of the following e-learning standards (depending on publishing options) [28]:

- AICC
- SCORM 1.2
- SCORM 1.3 (SCORM 2004)

8.3.2 Lesson Plan

Title: Line y=ax+b

Learning outcome: This unit attempts to help students to understand what is the role of variable a and b in the equation of a line of the form y=ax+b. After completing this unit, students will be able to realize that variable a is depended on the angle created between that line and the x-axis and this determine the slope of the line. Moreover, student will realize that the point (0,b) is the point of intersection with y-axis. At the end students will be able to solve mathematical problems using the above data.

Learning Flow:

1. Prerequisite Knowledge

At first a brief description about point's coordination is given in order to help students recall this knowledge. After students read this brief description a simple question follows that students have to answer to confirm that they did recall coordination of a point.

2. Experiment and observation

If the student does not answer correctly the previous question then he will not be able to move to the next activity. He will have to study more carefully the information about coordination and repeat the question. In case the student's answer is correct he can move to the next activity. Through this activity he will be able to observe the way the form of the line y=ax+b is changing while a takes different values and b remains constant. Then at the activity that follows the student has the opportunity to observe the changes of the line while variable a remains constant and b takes a range of values.

3. Test

At the end student has the opportunity to take a short test to evaluate himself and realize his weakness in order to study more and fills his gaps.

Chapter 9
Scope and Scale - Evaluation

Nowadays, we have in our island people from many places of the world and this affects the composition of school classes. A typical school class consists of students with different socio-cultural backgrounds, experiences, interests, learning styles etc. Thus, flexibility is important for the Cypriot education system because if, for example, a student does not have the ability to participate in a lesson he or she will miss the whole session material. The educator needs to plan the lesson and present assignments that: 1) meet the needs of everyone and 2) all students in the class can complete. The use of Units of Learning (UoL's) in the teaching process may offer to the educator a valuable tool in order to achieve this goal. The use of adaptive UoL's may ensure the adaptability of the lesson according to the needs of every student. During an adaptive UoL, for example, the learner may have the opportunity to choose on his own the sequence he prefers to perform the activities according to his leaning style. For example, deductive or inductive instruction may be enabled. Another example: different learning activities may be presented to the learners, depending on his performance at a previous questionnaire or test. In this way, the learning process is adapted to the learner's prerequisite knowledge.

9.1 Using a UoL

Some examples of how a tutor can take advantage of the learning scenarios of chapter 8 will be described in this chapter. These UoLs may be used selfsame or after making some changes on them.

9.1.1 Implementation during the lesson

The two adaptive scenarios described at chapter 8 can be used during the teaching process in a computer lab. After the determination of the level of their prerequisite knowledge, the students can be grouped and perform the appropriate activities in collaboration with each other. In this case the use of the chat and the forum widgets will probably be limited, since there exist possibility of face to face conversation and interaction. The role of teacher in this case would be mostly to observe the progress of every group and every student individually, guide them through the learning process and provide scaffolds in order to reach the right conclusions.

9.1.2 Implementation as a supplementary material

The leaning scenarios can also be used by the students as a supplementary material (after class). In this case, the student can review in his free time any points he may have not understood during the lecture. In case of a synchronous online session he may have the opportunity to ask questions through the forum or via the chat and get answers from his classmates or from the teacher and solve the available exercises. However, at the "Adaptive Surface Area" scenario the role of teacher can be ignored. The student can just practice alone, with the help of the feedback provided automatically by the system. Of course, this does not imply that any system can play the role of the teacher or even, substitute the teacher. The teacher has a major role to play especially with students of young age, because with his words can pique the imagination of students, motivate and encourage them. Additionally, the teacher is a point of reference for students, where they can be turned at any time for any question and get answers and advices as well. There is no system able to offer all this to students. An electronic system can strengthen the role of teacher by providing incentives (through multimedia such as videos, audios, photos etc.) and filling gaps in the teaching process.

9.2 Editing and reusing a UoL

The aforementioned learning scenarios can easily be uploaded in an on line repository (like the repository of the Open University of Netherlands, http://dspace.ou.nl/community-list). In this way, the educators will be able to locate, access and retrieve them since LOR allows registered or unregistered users to search and retrieve LO's from the repository, as described in Chapter 3/Section 3.3. Then, they can use either the original UoLs in an 'as is' form or modify them in order to meet their needs. There is a variety of modifications can be made in a UoL in order to adjust it so as to fit particular needs.

9.2.1 Modification of Learning Material

Firstly, probably the simplest modification that an educator can make on a scenario of a UoL retrieved from a repository, concerns the learning material per se. For example, if the educator wants to use the pattern of the "Adaptive Powers" scenario for a different subject he only needs to replace the learning material of mathematics with the material of the subject he wishes. Literally, in this specific UoL, he has to replace the html files of the resources and the word documents that contain the assignments. If the educator wants to use the pattern of "Adaptive surface area" scenario he has to change the questions of the QTI test, something that is relatively simple. By replacing the mathematical material with the material for example of a language, a physic, a history or a chemistry lesson, a UoL designed for a mathematics lesson can be reused for those lessons respectively. Furthermore, the same UoL can be used for example by a university professor for the scope of a web-based lesson. In this case, the professor should make further modifications in the structure (pattern) of the UoL, since the specific UoL was designed for a lesson on Chapter "Powers" which is included in the curriculum of mathematics of Second class of gymnasium. The university students are more mature as learners than the secondary school students, because they have already developed metacognitive capabilities, they have a clear idea about how knowledgeable they are and they can choose by themselves the difficulty level of material they need to study and practice. For this reason, besides the learning material, further modifications that concern the structure (pattern) of the UoL, are required. The whole learning material should be presented to the user in a selection activity structure instead of

sequence structure in order to enable the learner to choose on his own what he needs. Concerning the needed competence, an educator who has some basic computer knowledge will probably be capable to perform the above changes after attending a briefing on using the ReCourse Learning Design Editor and creating some simple html files.

9.2.2 Adding/Removing Roles

Furthermore, the learning scenarios of chapter 8 are susceptible to more complicated modifications. For example in the learning scenario titled "Adaptive Powers" two more roles for teachers could be added. In this way there will be three teachers and each of them will be responsible for a specific group of students attending a certain level of difficulty (from the tree levels offered). He will be responsible for answering their questions through the chat or the forum, guiding them to the right conclusions, correcting their assignments, sending them feedback and observing their progress. In a similar way, another teacher's role can be added to the "Adaptive surface area" scenario. This addition of roles is not a straightforward process and the educator have to be well trained and practiced with the ReCourse Learning Design Editor in order to be able to complete this modification successfully. On the other hand, roles can be removed more easily. For example, in "Adaptive surface area" scenario the role of teacher can be easily removed. Thus, the student will be able to practice by himself and get feedback from the system automatically.

9.3   Use of Widgets for Mobile Learning Purposes

9.3.1 Mobile Learning

Nowadays mobile devices such as smartphones, mobile phones, netbooks and laptop computersare spread worldwide. People use them not only for communication, business, entertainment, information retrieval and exchange, but also for learning.

Kneebone and Angus [55], define Mobile Learning as "the practice of learning, not just through the mobile devices but also through the flexible delivery and creation of

content, when and where the learner wants to access their learning". Another definition given by O' Malley et al. [77], define Mobile Learning as "any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies".

There are a lot of affordances of mobile learning [72], [103]:
- Manage different learning requirements: mobile learning enable students to learn at their own speed.
- Performance support: students have easy access to information, thus special knowledge is put in their hands, as a supportive tool. Also education of students is facilitated through the quick access to learning content
- Increased mobility: mobile devices offer the ability to learners to access learning content, as well as learning interactions anywhere such as cafes, museums, shopping malls and outdoor areas.
- Tine-saving: people can study either when travelling to their work or elsewhere.
- Interactive: mobile technologies enable the students to link with their teachers, with other students, as well as with other groups worldwide.

Having in mind the above affordances, experiential learning is of great importance as it uses experience in a unique context to facilitate knowledge acquisition and creation [64]. Lai et. al. [64], define experiential learning as "the process of creating knowledge through the transformation of experience and has been adopted in an increasing number of areas". According to Barab et. al. [09], during experiential learning, the learners have the ability to ground their understandings and new discoveries within their own previous concrete experiences to construct ideas and relationships actively in their own minds.

Experiential learning can be regarded as a four stage cycle [56]:
- Concrete experience
- Reflective observation
- Abstract conceptualization
- Active experimentation

Learners begin with the concrete experience upon which they develop observations and reflections. Afterwards, the learners direct their thoughts together to construct abstract concepts that can guide future actions. As soon as developed, the learners actively test their constructs, which in turn, leads to new experiences and renews the learning cycle [10].

9.3.2 Widgets Embedded in a UoL

There is a plenty of widgets that can be embedded in a UoL that are described below. The import of such widgets in a UoL creates great potentials for the use of the UoL in mobile learning.

eBook reader

First of all, ebook reader widget is useful for browsing and opening thousands of eBooks. This offers learner the possibility to download and read a book on his mobile device while travelling in a train or a bus, while waiting in a queue or while having his lunch. In this way the time he spends for these activities is not wasted. Moreover learner can have at the same time access to internet resources and is allowed to switch from one eBook or text to another. This possibility gives him the chance to compare and crosscheck the information he reads. This search is very helpful for learner in order to develop critical thinking and metacognitive skills.

Geolocator

Geolocator checks latitude and longitude coordinations of a desired point on the map Points added by clicking on the map. A far away point can be located by using location search. After selecting a point its longitude and latitude are displayed on a status bar automatically (Figure 1).
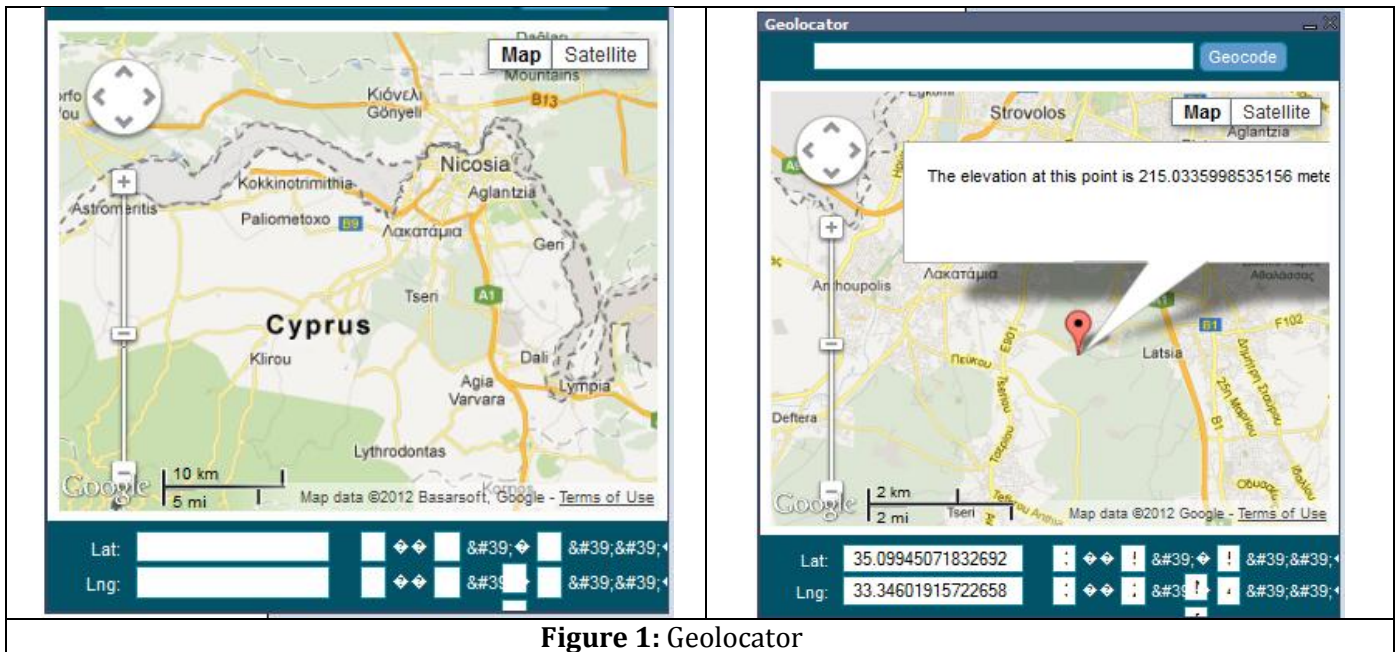
Figure 1: Geolocator

In 2007/2008 researchers/designers of WaagSociety and Freudenthal Institute designed a modern and social location based, mobile game that could engagged students in learning mathematics. The prototype was called MobileMath (Figure 2).
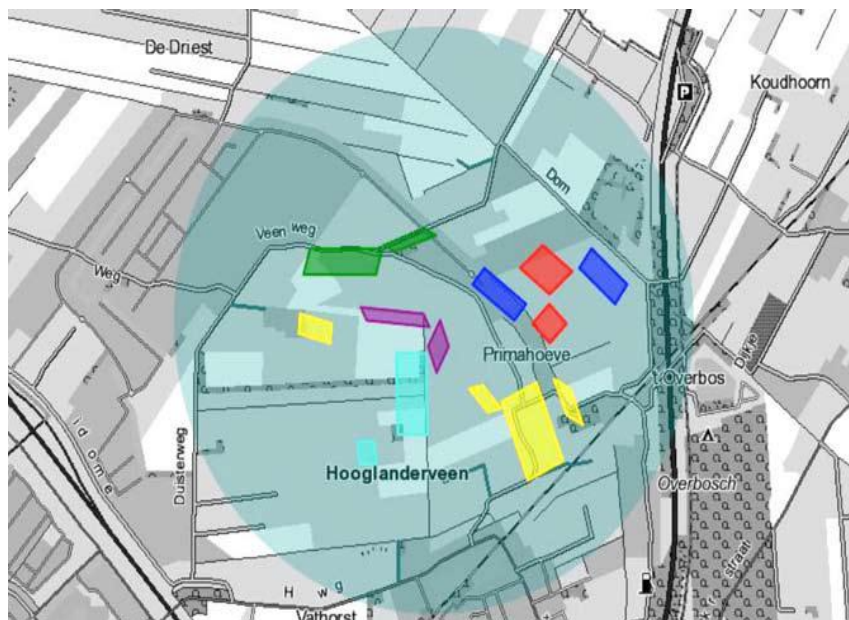
Figure: MobileMath [14]

MobileMath is played on a mobile phone with GPS. The playing field where teams compete on, can be defined anywhere. Every team constructs squares, rectangles or parallelograms covering the playing field. The winner team is the team that covers the larger area. This is done by physically walking to and clicking on each vertex (point). As the game proceeds the free playing space gets smaller. It is possible to 'hinder' other

teams and to deconstruct their shapes. Points are gained relative to the area of the shapes constructed or deconstructed. During the game, in real-time the tracks of all teams as well as all the constructed shapes are visible on each mobile phone [14].

Geolocator can be used for a similar play. This play promotes interaction and asks for strategic thinking. Through this game students can learn how to use GPS, how to read a map and how to construct quadrilaterals.

Distance Calculator

Distance Calculator displays the distance between selected points. After selecting two or more points the distance is displayed on a status bar automatically.

Figure 3: Distance Calculation

Distance Calculation can be used in designing activities concerning the curriculum of mathematics. Students can be asked to measure the height of a tall building or monument. The problem can be solved by simply photograph the building and measure the distance of two points on the ground using the Distance Calculation. Then, this distance can be used to calibrate a scale in the photograph and hence estimate the height [14].

This activity brings students confronted with a real, daily life problem and helps them understand and consolidate the meaning of scale, radio and analogy in an interesting way.

Level Tool

Level Tool widget simulates the Level Tool that civil engineers use to indicate whether a surface is horizontal or vertical or even level it with a "bull's eye" (Figure 4).

Figure 4: Level Tool [80]

In a scenario designed for "line slope" or "parallel and perpendicular lines" Level Tool can play a major role. Students can use Level Tool widget to level several surfaces and make their observations. In this way through their experience they will be able to understand the meaning of slope of a surface and conclude by their own that parallel surfaces have equal slopes.

9.4   Evaluation of a UoL

The evaluation of any educational venture is of great importance. The evaluation process provides useful feedback which the teacher and the school community, in general, can use to improve the quality of instruction they provide. Teachers can have an overview of the educational process and identify areas that need to be improved. There are a lot of cases that the teacher may have the impression that a specific method he had used had been useful for students but after the evaluation he had realized that it was not and that he needed to change it or improve it someway.

One of the tools that can be used for evaluation purposes is the questionnaire. The evaluation can be performed using online or paper based questionnaires. Although evaluation scores do not change when evaluations are completed online rather than on paper [07], [30], a consistent disadvantage of online course evaluations is that their response rate is low [04], [07]. The response rate can be significantly increased by sending reminder e-mails and by posting messages to online class discussions boards. Moreover, students leave more (and often more useful) comments on online evaluations compared to paper evaluations [04], [30].

Thus, the best way of conducting the evaluation of Learning Scenarios of Chapter 8 would be to use on line questionnaires. Firstly, the UoL might be implemented using a group of students with different backgrounds, different experiences etc. The teacher can get a first impression about students' opinions about the lesson by asking them to rate it (Fig. 9.1).
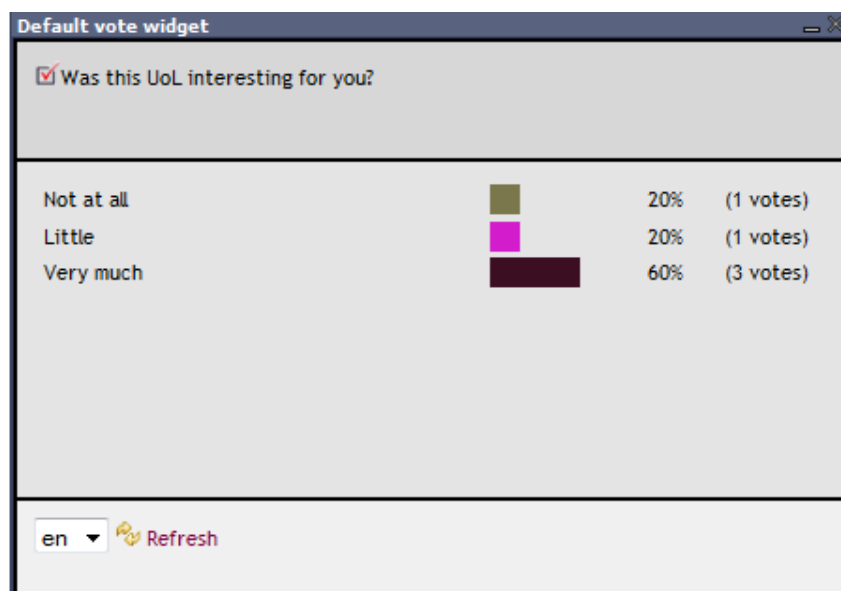
Figure 9.1: Vote Widget

A suitable idea would be to use the vote widget that is been launched at the end of the lesson. Complementary, for more detailed evaluation students can complete a short on line questionnaire. This questionnaire should contain appropriate questions for a comprehensive evaluation of the UoLs. For example, questions to clarify whether through this UoL it was easier or more difficult for students to understand the educational material compared to traditional teaching. Also, they should be asked if the UoL met their interests and offered them motivations. Students' answers in this question might give an indicator of the degree of which the goal of adaptation was

achieved. Also, students should be asked about their participation in the forums and in the chats, the reasons why they participated or not and if the discussion with the teacher and their classmates helped them. Finally, students should be asked if the feedback from the teacher or from the system helped them understand their mistakes and improve themselves. Their answers in this question provide an indicator of the degree of the effectiveness of the adaptive feedback.

On the other hand, the opinion of the teachers should be also taken into consideration. Teachers from different disciplines might use the UoL selfsame in their lesson or after proper modifications. Then, those teachers can be asked, through questionnaires or interviews, about their students' participation level in learning process (including forum and chat) and the level of interest they showed compared with other teaching methods. Finally, the students' improvement might reflects the effectiveness of the UoL. The degree of student's improvement can be evaluated by observing their progress through the tests that were included in the UoL and were successfully completed by the students. It is important take into account the progress of the student and not his grade. At the end, the teachers should be asked about the degree of difficulty of modifying and adjusting the particular UoL in order to meet their needs.

9.5 Conclusions

Widgets have a major role to play at the learning process. Through widgets learning from experience, namely experiential learning is strengthened. At the most examples above learners are called to face real problems of everyday life. This fact gives motivations to learners and makes learning process more interesting. This kind of activities motivates students in order to use their cooperative skills and develop their creativity and imagination in order to discover the necessary answers and achieve specific goals. Students finally learn how to learn, how to remember, how to think. In other words, students manage to develop metacognitive skills in order to be able to acquire knowledge by his own without the presence of teacher.

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Technical Annex
Designing a UoL

At this Technical Annex the description of the procedure followed is given, for installing all programs needed for the designing of a UoL. Also some difficulties are described that were met during this procedure and the way they were faced.

A.1   Installation of ReCourse Learning Design Editor

The latest version of ReCourse Learning Design Editor (version2.0.3), which was released in February 2010, was downloaded from:

http://tencompetence-project.bolton.ac.uk/ldauthor/

The downloaded file was unzipped and the Editor was installed.
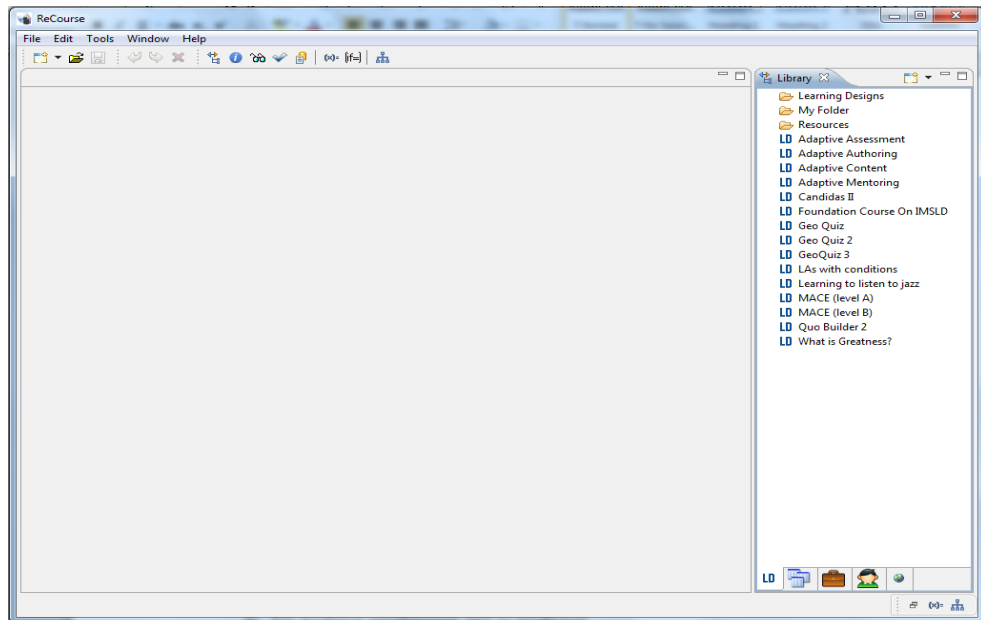
Figure 1: The ReCourse Learning Design Editor environment

A.2 Installation of CopperCore Runtime Environment (CCRT)

Afterwards, a modified version of the current CopperCore Runtime Environment (CCRT) was downloaded from:

http://tencompetence-project.bolton.ac.uk/ldruntime/index.html

This version has been modified to include the "Astro" Player and the Widget Server.

The downloaded file was unpacked into a local directory and CCRT was installed.

Problem starting CCRT: While clicking start_coppercore.bat to start CopperCore Runtime Environment the error message shown below was appeared:

JAVA_HOME is not set. Unexpected results may occur.

Set JAVA_HOME to the directory of your local JDK to avoid this message.

The figure shows the error message from windows console.
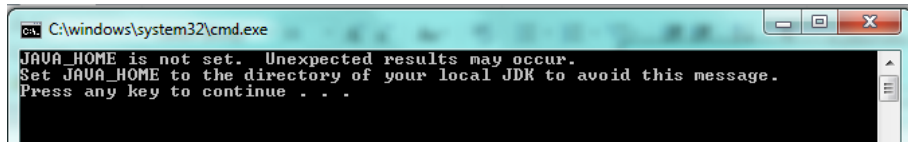
Figure 2: Error message while starting CopperCore Runtime Environment

Solution of the problem: The JDK (Java Development Kit), the main software of Java platform there was not at the path C:\ProgramFiles\Java. This is the reason the above problem occurred. The JDK includes tools useful for developing and testing programs written in the Java programming language and running on the Java platform.

A JDK was downloaded from:

http://www.oracle.com/technetwork/java/javasebusiness/downloads/java-archive-downloads-javase5-419410.html

and was saved at the path C:\Program Files\Java.

The variable JAVA_HOME was set at Environment Variables.
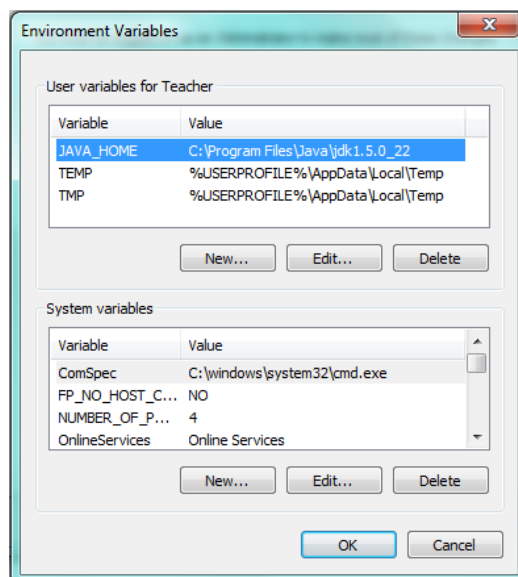
Figure 3: The variable JAVA_HOME is set at Environment Variables

A.3   Connection of ReCourse Learning Design Editor with wookie widget server

The URL of the server (http://localhost:8080) was set at preferences of ReCourse Learning Design Editor (as shown in Figure 4) in order to achieve the interconnection of two subsystems.
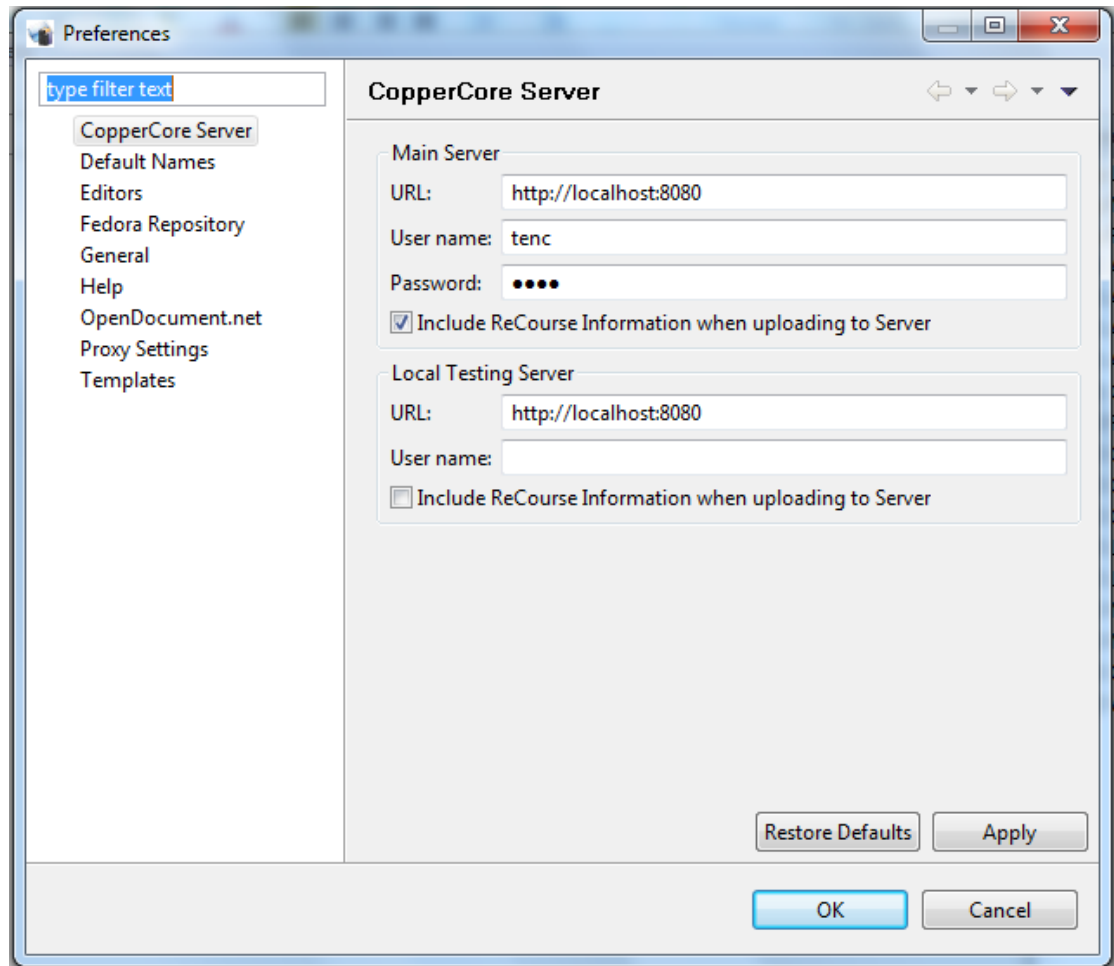
Figure 4: Connection parameters of ReCourse&CopperCoreServer

Problem in connection of the two subsystems: A connection problem was appeared and the following error message was presented:

java.net.ConnectException: Connection refused: connect
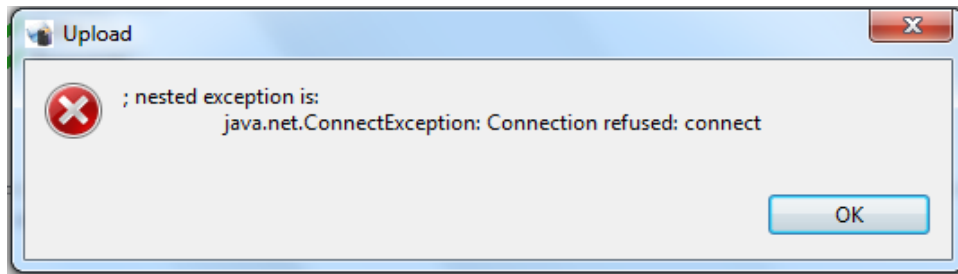
Figure 5: Error message in connection procedure

Solution of the problem: This error was due to the firewall of Windows, which does not allow the interconnection of subsystems, in order to protect the computer from security threats like viruses or malicious software. To overcome the problem the firewall was temporarily disabled from the control panel and was setting an authorized license for communication of Recourse Learning Design Editor with other subsystems through the firewall.
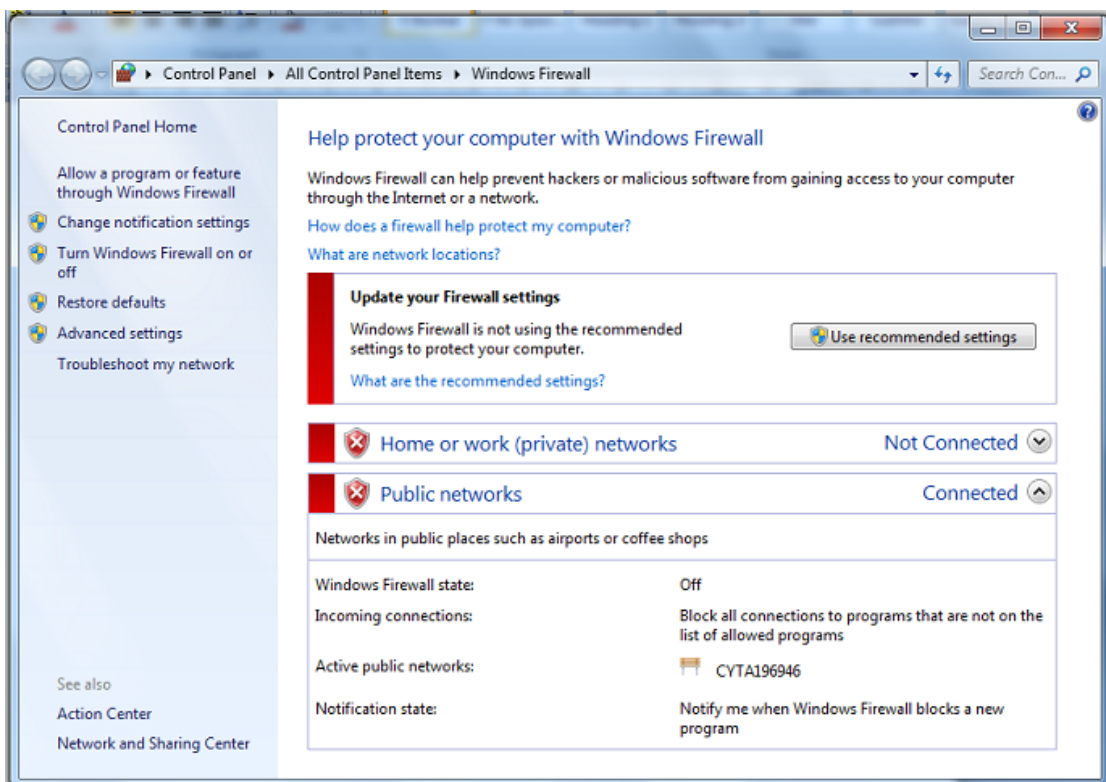
Figure 6: Disable of Firewall
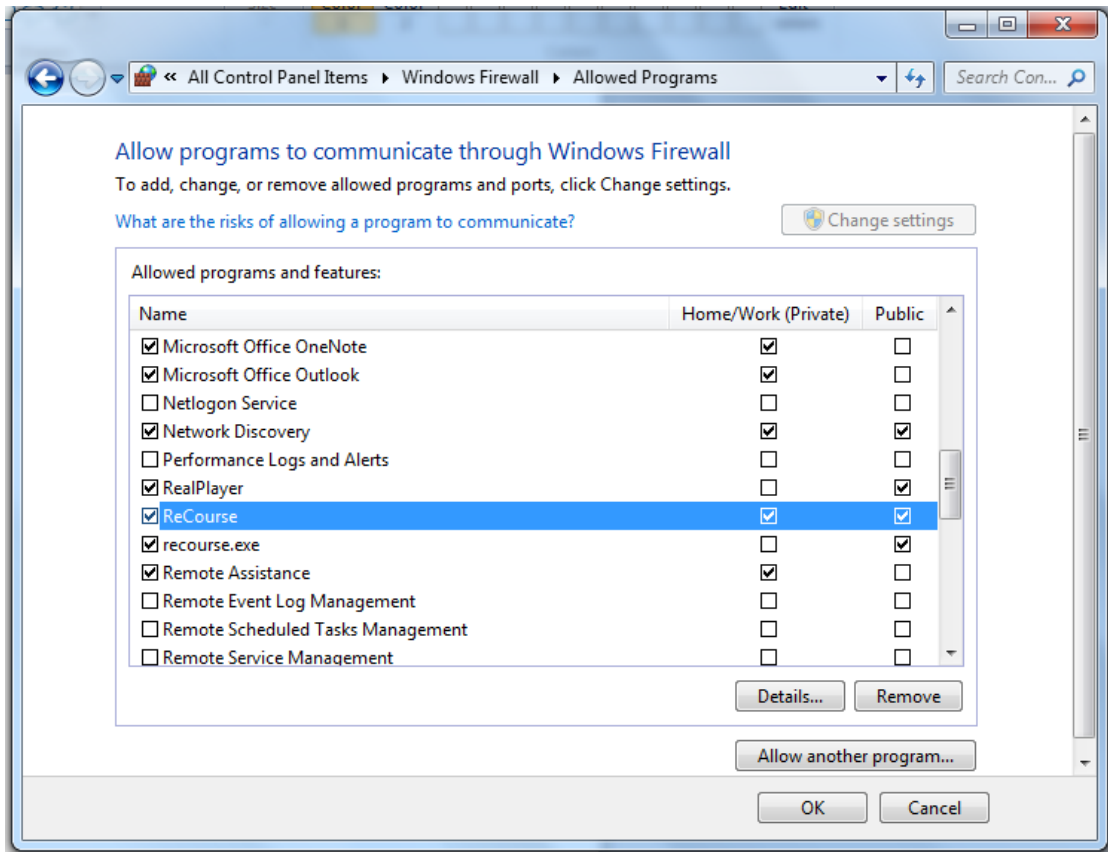
Figure 7: Recourse Learning Design Editor is allowed to communicate with other subsystems through Windows Firewall

Finally the User Account Control was set to never notify about changes on the computer that require administrator-level permissions.
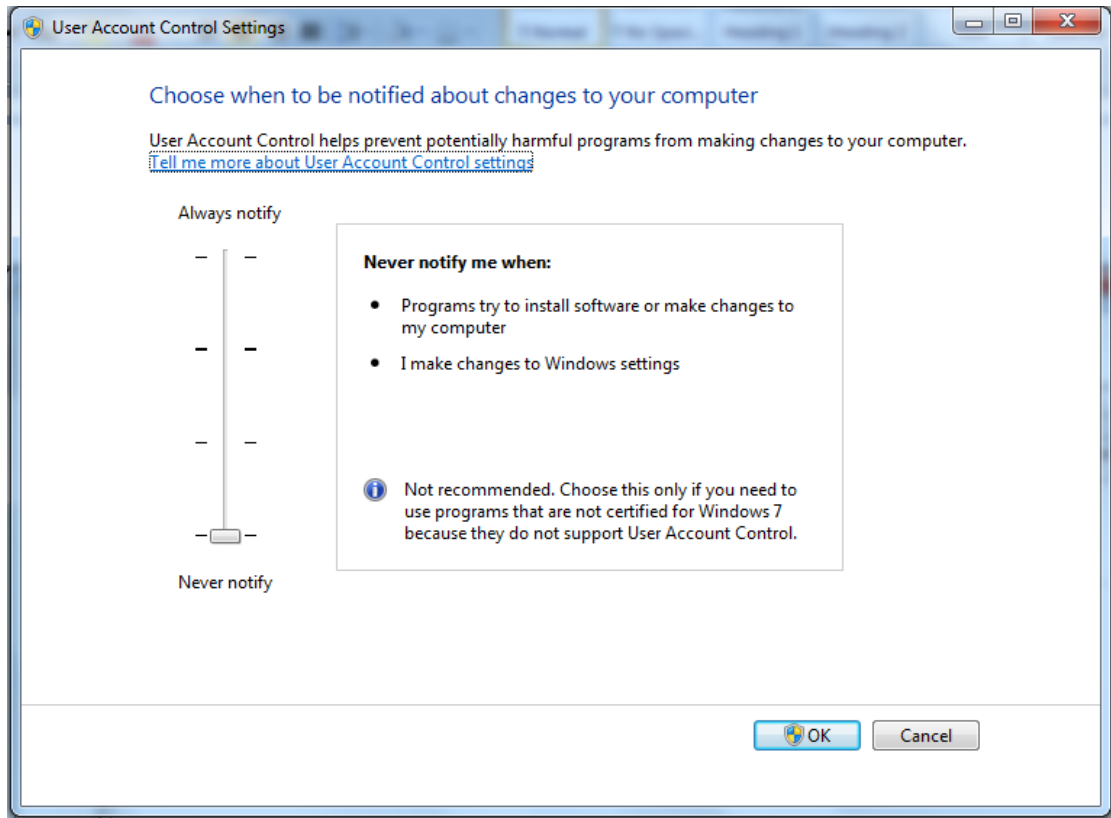
Figure 8: User Account Control Settings

After performing the operations described above, ReCourse Learning Design Editor was successfully connected with wookie widget server and was able to identify the 3 widgets available on the server.
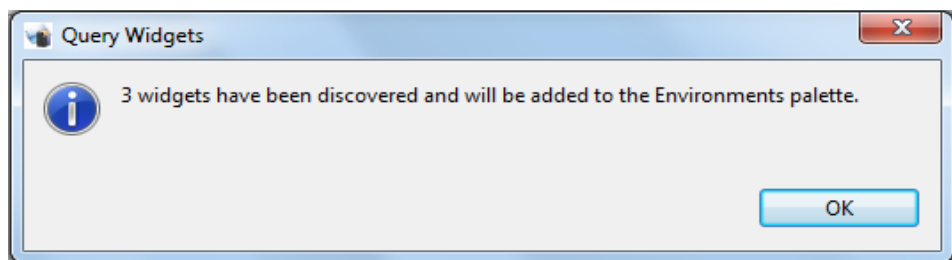
Figure 9: Message of identifying the 3 widgets of Wookie Widget Server from ReCourse Learning Design Editor

A.4 Connection of ReCourse Learning Design Editor with wookie widget server

By clicking start_coppercore.bat of CopperCore Runtime Environment the wookie widget server is starting. By following the URL: http://localhost:8080/wookie the access to the index page of Wookie Widget Server is enabled.

Figure 10: Index page of Wookie Widget Server

Then, by clicking on 'admin' and inserting the user name and password (user name: java and password: java) is enabled the navigation to the Administration page.
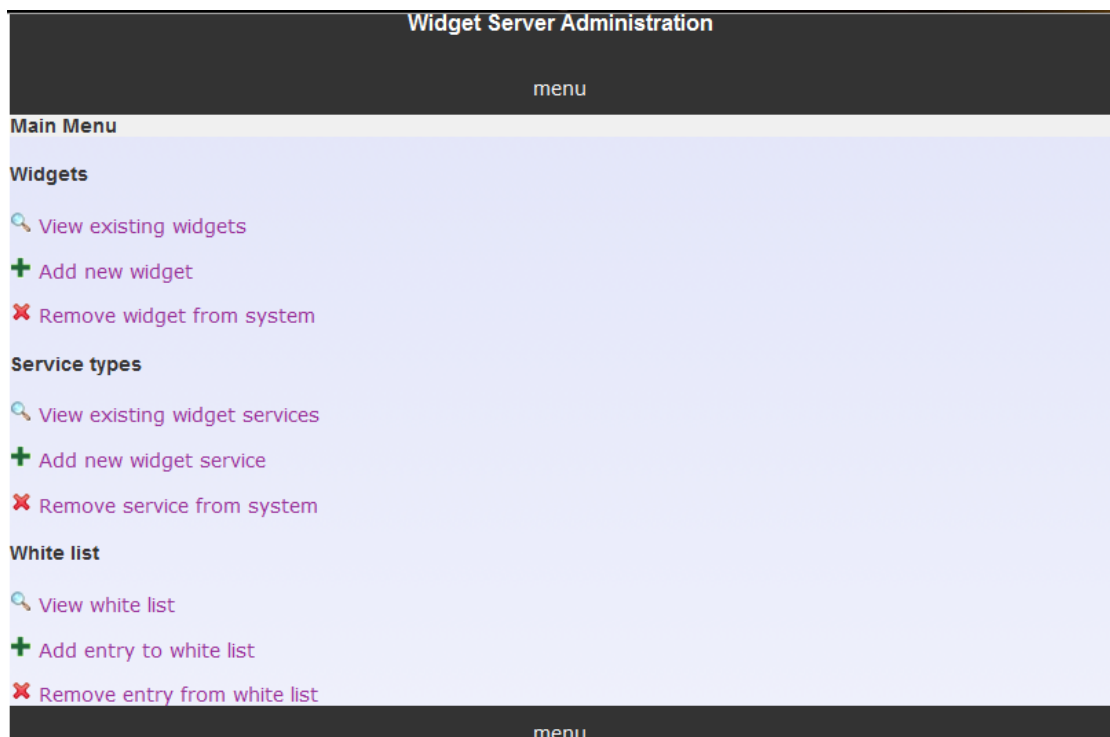
Figure 11: Administration page of Wookie Widget Server

Clicking on 'View existing widget' from 'widget' list, the 3 widgets are available in Wookie Widget Server are presented.

Figure 12: The 3 widgets available in Wookie Widget Server

To be able to add new widgets should first be created new widget types. This is attained by selecting 'Add new widget services' from the 'Service types' list and inserting the title of the type of widget in the table appears as shown in the Figure 12.
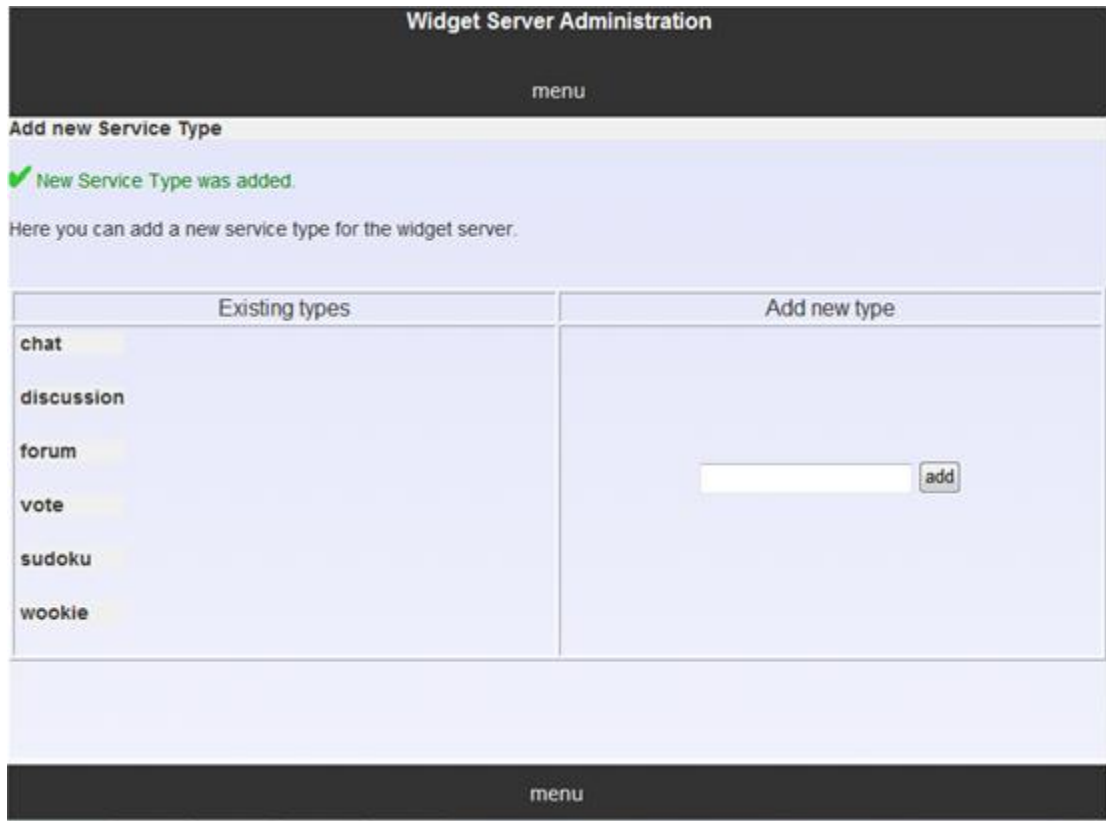
Figure 13: Addition of two new widget types, sudoku and wookie

Afterwards, the new Widget is added to the server by clicking 'Add new widget' from 'Widgets' list and selecting the widget type.

Widget Server Administration

menu

Current Widgets

This page lists the widgets that have been imported into the Widget Server. You can also change set the type of a widget here to be the the default one. The current default widget types are in Red. If you wish to set a widget to be the default for another type, then click its title to set it. If you wish to remove one of the service types for a particular widget, then click the (✖) icon next to it. If you wish to add another service type to an existing widget, then click the (Add new ✚) icon for that particular widget.

Title	Default chat widget
Url	/wookie/wservices/www.tencompetence.org/widgets/default/chat/index.htm
Guid	http://www.tencompetence.org/widgets/default/chat
Height	360
Width	505
Types	(chat ✖) (Add new ✚)
Title	Default discussion/forum widget
Url	/wookie/wservices/www.tencompetence.org/widgets/default/forum/index.htm
Guid	http://www.tencompetence.org/widgets/default/forum
Height	350
Width	520
Types	(forum ✖), (discussion ✖) (Add new ✚)
Title	Default vote widget
Url	/wookie/wservices/www.tencompetence.org/widgets/default/vote/index.htm
Guid	http://www.tencompetence.org/widgets/default/vote
Height	350
Width	500
Types	(vote ✖) (Add new ✚)
Title	Wave Test: Sudoku
Url	/wookie/wservices/generated-uid-92B546BF-6B81-ACCC-8598-B40B79813886/sudoku.html
Guid	generated-uid-92B546BF-6B81-ACCC-8598-B40B79813886
Height	380
Width	520
Types	(sudoku ✖) (Add new ✚)
Title	WookieWiki
Url	/wookie/wservices/generated-uid-88DB1D41-842E-7489-B076-5A850D02C211/index.html
Guid	generated-uid-88DB1D41-842E-7489-B076-5A850D02C211
Height	520
Width	320
Types	(wookie ✖) (Add new ✚)

menu

Figure 14: Appearance of the two new widgets 'sudoku' and 'wookie' that have been added

By adding the two new widget in wookie widget server the total number of widgets have risen to 5. All 5 widgets are identifying by the Recourse Learning Design Editor as shown in the Figure 15.
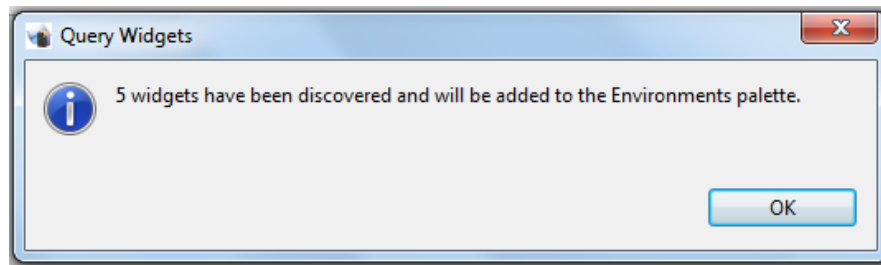
Figure 15: Message of identifying the 5 widgets of Wookie Widget Server from ReCourse Learning Design Editor

A.5   Validation Problem

During the building of "Adaptive Powers" Learning Scenario a validation problem was occurred. The UoL was successfully uploaded to the server but the activity "Level Choice" was not appeared. This problem was caused by a syntax error in prerequisite_knowledge.xml file where there was the element type "p" but the matching end-tag "</p>" did not exist. "In HTML, some elements do not have to have a closing tag. In XML, it is illegal to omit the closing tag. All elements must have a closing tag" (http://www.w3schools.com/xml/xml_syntax.asp?output=print}.

Figure 16: Error message by CCRT

The syntax error was corrected and the UoL was 'played' without a problem.