ISURE: Guideline for the integration of instructional models with open educational content in IMS Learning Design

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Executive Summary

The IMS Learning Design (IMS-LD) specification expresses a standardized modeling language for representing learning designs as a description of teaching and learning processes. The learning designs are created using IMS-LD editors, and executed by IMS-LD players.

As IMS-LD has evolved in the last years to an important specification for instructional models within the technology-enhanced learning area, it is mainly addressing educational experts familiar with learning design. Hence, a more practical guideline for educators who are not already IMS-LD experts is still missing in the literature. Thus, the main objective of this ISURE (ICOPPER Suitability Report for Better Practice) is to provide on the basis of best-practice experiences and recommended tools a step-by-step process model for the use of IMS-LD. This process model covers the following four phases:

- Phase 1: Specification of the contextual requirements of a course,
- Phase 2: Design of a course by use of adequate IMS-LD editors,
- Phase 3: Delivery of a course by means of corresponding IMS-LD players, and
- Phase 4: Reuse of a course with the aid of an appropriate IMS-LD editor.

For each of the four phases, educators get instructions about what steps to conduct to design an instructional model, deliver it to end users and reuse it for further courses. This starts for instance with specifying the target audience or defining the mode of learning delivery (either as blended learning, pure presence learning or social learning application). This covers steps like selecting the standardization format of open education content (such as SCORM or IMS Common Cartridge compliant content) or like the visualization type of the learning logic (table-based vs. graphical) within a Unit of Learning. This ends finally with questions how to specify so-called learning outcome profiles within IMS-LD models in order to describe the learning objectives achieved within a course.

All these questions are being answered in this deliverable. This is done based on a recommended set of tools for learning design and delivery. The tools selected shall hereby be seen as best-practice recommendations and samples representing a specific type of tools.

Thus, this guideline will help educators to better understand the entire IMS-LD design, delivery, and reuse process chain, and in this way contribute to a wider application and uptake of IMS-LD.
Table of Contents

1 INTRODUCTION .............................................................................................................. 7
2 FOUNDATIONS .............................................................................................................. 9
   2.1 OPEN EDUCATIONAL CONTENT ........................................................................ 9
   2.2 INSTRUCTIONAL MODEL ................................................................................. 9
   2.3 IMS LEARNING DESIGN ................................................................................... 9
3 METHODOLOGICAL BACKGROUND ......................................................................... 13
4 A PROCESS MODEL FOR THE USE OF IMS LEARNING DESIGN ...................... 17
   4.1.1 Phase 1 – specify contextual requirements ........................................... 17
   4.1.1.1 Target audience ......................................................................................... 17
   4.1.1.2 Application target ...................................................................................... 17
   4.1.1.3 Unit of learning delivery mode ................................................................. 18
   4.1.2 Phase 2 – design unit of learning ............................................................... 18
   4.1.2.1 Design purpose ........................................................................................... 18
   4.1.2.2 Tool capability ............................................................................................ 18
   4.1.3 Phase 4 – deliver unit of learning ............................................................... 20
   4.1.3.1 Organizational embedment of the IMS-LD player ................................ 20
   4.1.3.2 Tool capability ............................................................................................ 20
   4.1.4 Phase 4 – reuse unit of learning ................................................................. 21
5 A STEP-BY-STEP GUIDELINE FOR THE USE OF IMS LEARNING DESIGN .... 25
   5.1 Phase 1 - specify contextual requirements ................................................ 26
   5.1.1 Target audience ............................................................................................. 26
   5.1.2 Application target ........................................................................................... 26
   5.1.3 Unit of learning delivery mode ................................................................. 27
   5.2 Phase 2 - design unit of learning ................................................................ 28
   5.2.1 Design unit of learning with the Graphical Learning Modeller ............... 30
   5.2.2 Design unit of learning with the Recourse LD editor .................................. 39
   5.3 Phase 3 - deliver unit of learning ................................................................. 46
   5.4 Phase 4 - reuse unit of learning ................................................................. 53
6 CONCLUSIONS .............................................................................................................. 55
7 REFERENCES ............................................................................................................... 56
Table of Figures

Fig. 1. IMS-LD main concepts - overview [21]................................. 12
Fig. 2. Towards a practice-oriented IMS-LD guideline for educators - overview .......................... 13
Fig. 3. Create learning design (GLM).................................................. 31
Fig. 4. Start learning design (GLM)...................................................... 31
Fig. 5. Create learning activity (GLM).................................................. 32
Fig. 6. Match learner role to learning activity (GLM)................................. 32
Fig. 7. Match learning supporter role to support activity (GLM)...................... 33
Fig. 8. Synchronize learning/support activity (GLM)................................ 34
Fig. 9. Add collaboration service to learning/support activity (GLM).................. 34
Fig. 10. Add linked flash video (URL) to learning activity (GLM)....................... 35
Fig. 11. Add flash video (file) to learning activity (GLM)............................... 35
Fig. 12. Add SCORM WBT to learning activity (GLM)................................ 36
Fig. 13. Add linked collaboration service (URL) to learning activity (GLM)............. 36
Fig. 14. Add linked collaboration service to learning activity- activity description (GLM) 37
Fig. 15. Add online test to learning activity (URL).................................... 37
Fig. 16. Add online test to learning activity (GLM).................................... 38
Fig. 17. Creating learning design (Recourse LD editor)................................. 40
Fig. 18. Create learning design (Recourse LD editor)................................ 40
Fig. 19. Specify learning design (Recourse LD editor)................................ 41
Fig. 20. Create module/play (Recourse LD editor)...................................... 42
Fig. 21. Create learning activity (Recourse LD editor)................................. 42
Fig. 22. Create environment (Recourse LD editor)..................................... 43
Fig. 23. Create support activity/generate act (Recourse LD editor)..................... 43
Fig. 24. Match learner role to learning activity (Recourse LD editor)................... 44
Fig. 25. Create environment (Recourse LD editor)..................................... 45
Fig. 26. Create environment (Recourse LD editor)..................................... 45
Fig. 27. Match SCORM WBT to learning activity (Recourse LD editor)............... 45
Fig. 28. Match collaboration service to learning/support activity (Recourse LD editor) 46
Fig. 29. Search for and retrieve unit of learning (Clix ICOPER)......................... 48
Fig. 30. Import unit of learning (Clix ICOPER)........................................ 48
Fig. 31. Import role-mapping (Clix ICOPER)........................................... 49
Fig. 32. Initiate UoL instantiation/Instantiate UoL – step1 (Clix ICOPER)............... 49
Fig. 33. Instantiate UoL – step2 (Clix ICOPER)......................................... 49
Fig. 34. Instantiate UoL – step3 (Clix ICOPER)......................................... 50
Fig. 35. Instantiate UoL – step4 (Clix ICOPER)......................................... 50
Fig. 36. Learner administration (Clix ICOPER).......................................... 51
Fig. 37. Learner course entry point (Clix ICOPER)...................................... 51
Fig. 38. Answer tree-based visualization of learning delivery (Clix ICOPER)........... 52
Fig. 39. Execute learning activity (Clix ICOPER)....................................... 52
Fig. 40. Provide feedback on UoL activity-level (Clix ICOPER)........................ 53
Fig. 41. Reuse UoL with the Recourse LD editor......................................... 54

Table of Tables

Tab. 1. Process model for the use of IMS-LD........................................... 24
Tab. 2. Best practice IMS-LD editors - overview..................................... 29
Tab. 3. Designing a UoL with the Graphical Learning Modeller – steps overview........ 30
Tab. 4. Designing a UoL with the Recourse LD editor – steps overview................. 39
Tab. 5. Best practice IMS-LD player - overview....................................... 46
Tab. 6. Delivering a UoL with the Clix ICOPER IMS-LD player – steps overview........ 47
ISURE: Guideline for the integration of instructional models with open educational content in IMS Learning Design

**List of Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPMN</td>
<td>Business Process Modeling Notation</td>
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<tr>
<td>EPC</td>
<td>Event-driven Process Chain</td>
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<td>GLM</td>
<td>Graphical Learning Modeller</td>
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<td>IMS-CC</td>
<td>IMS Common Cartridge</td>
</tr>
<tr>
<td>IMS-LD</td>
<td>IMS Learning Design</td>
</tr>
<tr>
<td>ISURE</td>
<td>ICOPER Suitability Report for Better Practice</td>
</tr>
<tr>
<td>OICS</td>
<td>Open ICOPER Content Space</td>
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<tr>
<td>UoL</td>
<td>Unit of Learning</td>
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<tr>
<td>WBT</td>
<td>Web-Based Training</td>
</tr>
</tbody>
</table>
1 Introduction

The IMS-LD specification expresses\(^1\) a standardized modeling language for representing learning designs as a description of teaching and learning processes. The learning designs are created using IMS-LD editors, and executed by IMS-LD players.

Thereby, IMS-LD offers educators many benefits, amongst them:

- IMS-LD as a means to generate, and structure ideas in general (e.g. in projects).
- IMS-LD as a means to provide mainstream offers (e.g. “introduction to marketing”), respectively so-called special offers (e.g. scarce/special subject such as “international marketing and/or rare formal trainings).
- IMS-LD as a means to support:
  - The management/organization of a blended learning offer,
  - Distance learning phases,
  - Work-experiences/co-op programs, and
  - “In-between-times” (e.g. supporting learners during semester break).

However, as IMS-LD has evolved in the last years to an important specification for instructional models within the technology-enhanced learning area, it is mainly addressing educational experts familiar with learning design. Hence, a more practical guideline for educators who are not already IMS-LD experts is still missing in the literature. Thus, the main objective of this ISURE is to provide on the basis of best-practice experiences and recommended tools a step-by-step process model for the use of IMS-LD. This process model covers the following four phases:

- Phase 1: Specification of the contextual requirements of a course,
- Phase 2: Design of a course by use of adequate IMS-LD editors,
- Phase 3: Delivery of a course by means of corresponding IMS-LD players, and
- Phase 4: Reuse of a course with the aid of an appropriate IMS-LD editor.

Hence, by means of this ISURE, educators from two major application areas (higher education, and vocational training) are guided from the specification of contextual requirements to the design, the delivery, and the reuse of an IMS-LD compliant course in order to successfully deploy IMS-LD in current teaching practice. Thereby, the consideration of vocational training settings is due to the fact that higher education institutions such as business schools do more and more behave like vocational training providers. Thus, by integrating the vocational viewpoint, higher education settings are enabled to learn more about how to use IMS-LD from a vocational training perspective. In so doing, the integration of the vocational training viewpoint is considered to contribute to a wider application and uptake of IMS-LD.

\(^1\) By being expressive of pedagogical approaches, rather than prescriptive, the language facilitates the development of new pedagogical approaches [21].
The way towards the guideline is structured as follows:

Firstly, Chapter 2 provides more insights into the foundations relevant to the guideline, namely open educational content, instructional model and IMS-LD. This chapter is therefore dedicated to educators who want to learn more about the understanding of open educational content, instructional models and IMS-LD in the realm of this guideline, and how these concepts relate to each other.

Chapter 3 is dedicated to those educators who want to learn more about the methodological background of the guideline. Based on the methodology laid out in Chapter 4, Chapter 5 provides a four-phase step-by-step guideline for educators on how to specify, design, deliver and reuse IMS-LD compliant Unit-of-Learning (UoL). Finally, Chapter 6 summarizes the main findings.
2 Foundations

Within this chapter, the main concepts of this ISURE are explained in more detail. In so doing, each reader should be enabled to better understand these concepts which are in turn relevant to a consistent reading of the guideline presented in Chapter 5.

2.1 Open Educational Content

According to the IMS-LD specification, educational content is defined as “any reproducible and addressable digital or non-digital resource used to perform learning or support activities” [22]. With respect to open content, educational content can be understood as “digitized materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research” [30]. Thereby, exemplary open educational content formats are: Flash video [2], text file (e.g. PDF, Word), Web-content [22] as well as SCORM 2004- [1] and/or IMS-CC-compliant [17] Web-Based-Training (WBT).

Consequently, in this ISURE open educational content is understood as follows: Any reproducible and addressable digital resource such flash videos [2], text files (e.g. PDF, Word), Web-content [22] as well as SCORM 2004- [1] and/or IMS-CC-compliant [17] WBTs., offered freely and openly for educators, students and self-learners to use and reuse, aiming at supporting learning or support activities.

2.2 Instructional Model

An instructional model, respectively a teaching method (see D3.1),\(^1\) is a learning outcome oriented set of activities (i.e. teaching and learning processes) to be performed by learners and learning supporters, and used by both of them in the context of a certain learning environment (e.g. IMS-LD player).

An instructional model is implemented in a UoL and can be characterized in the sense of:

- curriculum-based learning: the learning supporter is primarily responsible for conveying information to a group of learners. The direction of the communication tends to be one-way, from the learning supporter to the learners (e.g. lecture).
- collaborative learning: high amount of collaboration/communication among learners as well as between the learning supporter and learners. In general, learning is facilitated by active learner participation that is considered to be an effective means of ensuring learners’ involvement in the learning process.
- resource-based learning: focus on self-directed, incremental, search-based instructional models.

2.3 IMS Learning Design

The main objective of IMS-LD is the provision of a containment framework of elements that can describe any design of a teaching-learning process in a formal way [22]. Thereby, the originally intended objectives of IMS-LD are [26, pp. 6-7]:

- The standardized description of an adaptive learning and teaching process which takes place in a computer-managed course, i.e. these courses:
  - are “developed” before they are used,
  - can be used by different groups/classes of learners at different times (principle: “Develop ones, run many times”).

\(^1\) Note: In this report the term instructional model is synonymously used to the term teaching method [28, p. 11].
are managed by the computer (here: Runtime), not by the teacher, and
are designed to attain some learning outcomes (see WP2) for a given target
group (prerequisites) as effective and efficient as possible for the individual
learner.

The support of all types of learning designs based on various pedagogical approaches.
To have the learning and support activities at the centre, not the content.
To provide an integrative framework for a large number of (rich media) open
educational content formats such as IMS-CC [17], IMS Content Packaging [18],
SCORM 2004 [1], IMS Question and Test Interoperability specification [23] as well
as collaboration services (e.g. audio/video conference, forum, and virtual classroom).

The IMS-LD specification is thus considered to be an answer to the shortcomings of existing
learning technology specifications, focusing mainly on the sequencing of learning objects.
This is due to the fact that IMS-LD links activities to environments (consisting of resources
and services) and roles (e.g. learner, learning supporter), all of them managed by a teaching
method, respectively instructional model (see Chapter 2.2). Thereby, the instructional model
is implemented into a so-called UoL. The UoL thus can be understood as a contextualized,
self-contained unit of education or training such as a course, a module, a lesson, etc., which
uses (collaboration) services, open educational content as well as instructional models, and
which is designed by corresponding IMS-LD editors, and rendered by particular IMS-LD
players [31].

In this sense, the IMS-LD specification expresses\(^1\) a standardized modeling language for
representing learning designs as a description of teaching and learning processes able to be
executed by a software system, being an IMS-LD editor and/or player. The software in turn
coordinates all involved roles (e.g. learner, learning supporter), the provision of open
educational content as well as corresponding (collaboration) services [16].

With respect to learning delivery modes, IMS-LD supports mixed mode delivery (blended
learning) enabling traditional approaches such as face-to-face teaching, the use of books and
journals, lab work, and field trips to be also specified as learning activities and combined with
computer-supported learning [21].

Hence, IMS-LD shows the following characteristics which may support educators in their
teaching activities [34]:

- Support of pure present, pure distance, and/or blended learning delivery modes.
- Description of instructional models as multi-actor workflow processes, instead of
  single actor activity tree, i.e. enabling:
  - Activity-based learning as well as,
  - Role-based learning.
- Integration of the description of collaboration services\(^2\) such as:
  - Send-Mail Service.

\(^1\) By being expressive of pedagogical approaches, rather than prescriptive, the language facilitates the
development of new pedagogical approaches [21].

\(^2\) According to the IMS-LD specification, the selection of collaboration services to be included into the IMS-LD
specification needs to be driven by the community [21]. We therefore urge IMS-LD operators, and developers
to agree upon a core set of relevant collaboration services to foster (collaboration) service-related
interoperability. This means defining an application profile of the IMS-LD specification which captures the
pails which are most relevant for current/good practice. The definition of such core profiles is a key part of the
strategy of IMS. However, as far as the authors know, this has not been done for IMS-LD so far. In our
opinion, it might be most useful if iCoper could propose such a profile.
• Conference Service, which in turn can be divided into three subtypes, namely:
  • Synchronous Conference (e.g. chat, audio/video conference): These are group communication systems, which enable groups to communicate and work with each other in real time.
  • Asynchronous Conference (e.g. forum): These are group-messaging systems that use a store (inbox) for incoming messages. These are normally ordered in (nested) topics (conferences).
  • Announcement Conference: This is a message sent to users to inform them about new events or relevant information. Announcements (i.e. one2many asynchronous conference) are declared in the environment/service/conference object with the conference-type set to announcement.

• Implementation of a variety of instructional models (see chapter 2.2).
• Integration of rich (media open) educational content such as:
  • SCORM WBTs, or
  • IMS-CC WBTs.
• Reusability of (particular aspects of) an IMS-LD UoL.

Thus, the overall scope of the IMS-LD specification is the description of a formal way to represent the structure of a UoL and the concept of a pedagogical method by developing a framework to support pedagogical diversity and innovation, while promoting the exchange and interoperability of e-learning materials [20].

To conclude, Figure 1 (p. 12) summarizes the main concepts of IMS-LD and their relationships amongst each other in order to establish a common basis for the subsequent elaborations.¹

¹ For further reading see [28].
ISURE: Guideline for the integration of instructional models with open educational content in IMS Learning Design

Fig. 1. IMS-LD main concepts - overview [21]
3 Methodological Background

In the following, the methodological background for the derivation of a process model will be described. This process model in turn will be described in Chapter 3, and, at the same time, patterns the guideline of Chapter 4. In so doing, this process model contributes to the “process level/component” of the ICOPER Reference Model. Furthermore, while deriving the process model we drew back on major key concepts of WP3 such as instructional model, respectively teaching method, as well as UoL. Beyond, the consideration of vocational training settings was due to the fact that higher education institutions such as business schools do more and more behave like vocational training providers. Thus, by integrating the vocational viewpoint, higher education settings are enabled to learn more about how to use IMS-LD from a vocational training perspective. In so doing, the integration of the vocational training viewpoint is considered to contribute to a wider application and uptake of IMS-LD.

Within Phase 1 (see Figure 2), three (educational) expert focus groups were conducted in order to a) elicit educators’ requirements, and b) install a process model (see Table. 1, pp. 23 - 24) based on which a concrete guideline should be derived [7, 35, 38]. In so doing, one of the main objectives of the first workshop (“Towards an application profile of IMS-LD collaboration services”2), held in the realm of the ECTEL 2009, Nice/France), was the mutual agreement amongst ICOPER educational experts upon practice-relevant collaboration services to be included into a) a new version of the IMS-LD specification (i.e. detecting potential candidates for application profiling), and b) the guideline. Participating ICOPER experts represented the following partners:

- Humance
- IMC
- Kaunas University of Technology
- Open University Netherlands
- Open University UK

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1 See D7.1: iCoper Reference Model (IRM), Conceptual Model.
2 The mutual agreement on IMS-LD collaboration services is one of the objectives of D5.2 with respect to the “data layer” of the iCoper Reference Model.
University Jyväskylä

The represented ICOPER consortium partners were selected according to different criteria, such as geographical coverage, size and type of the institution (e.g. (open) university, or company), as well as background (pedagogical experts with experience in technology-enhanced learning). The corresponding outcomes are presented in Chapter 4.

Beyond, the main objective of the second expert workshop of Phase 1 (“Industry workshop: New directions in Learning Design and Delivery”, held on the 23rd of November 2009 at IMC headquarter), was the validation of ICOPER-specific developments which should enhance the application, respectively the guideline to be derived, and thus the adoption of IMS-LD in current practice. Participating industry partners were: Festo Virtual Academy/Germany¹, and Hager/Germany. The corresponding outcomes are presented in Chapter 4.

Finally, the main objectives of the third and last workshop of phase 1 (“Tools to model and deliver complex Units of Learning”, held on the 3rd of December 2009 at Institut für Wissensmedien – Koblenz University²), were as follows:

- Introduce IMS-LD as a promising specification for eLearning purposes in higher education settings,
- Carve out major strengths and weaknesses of IMS-LD from the educators’ point of view,
- Compile educators’ (practical) requirements/suggestions with a view to the following phases relevant to the use of IMS-LD:
  - Phase 1: Specification of the contextual requirements of the UoL,
  - Phase 2: Design of a UoL by use of adequate IMS-LD editors,
  - Phase 3: Delivery of the UoL by means of corresponding IMS-LD players, and
  - Phase 4: Reuse of the UoL with the aid of a appropriate IMS-LD editor.
- Train educators how to design and deliver IMS-LD compliant UoL. Thereby, the Graphical Learning Modeller (GLM) was deployed as the best practice IMS-LD learning design editor, and the integrated Clix ICOPER IMS-LD player as the best practice learning delivery environment.

In order to better carve out educators’ requirements/suggestions, the requirements elicitation method “projective analysis” was applied [15, 25]. Due to the novelty, respectively the lack of adoption, of IMS-LD and its corresponding tools this approach seemed to be well-suited to learn more about educators’ practice-oriented requirements [15, 25]. The whole procedure was recorded with a video camera and analyzed according to the principles of the qualitative content analysis [27]. The corresponding results are explained in more details in Chapter 4. In so doing, the represented participants were selected according to the educators’ background and (technology-enhanced) teaching experience (computer scientists, pedagogical experts, and psychologists with experience in technology-enhanced learning as well as teacher to student, and teacher to teacher training). The corresponding outcomes are presented in Chapter 4.

Within Phase 2 (see Figure 2, p. 13), one (educational) expert focus group was conducted (“IMS-LD Best Practice Guideline for Educators: Reviewing the D5.2 Process Model”, held on the 4th of February 2010 in the realm of the ICOPER GA, Vienna/Austria). Thereby, the

main objective was the validation of the initial process model of Phase 1 (see Figure 2, p. 13) based on which a concrete guideline should be derived (chapter 4). Participating ICOPER educational experts represented the following partners:

- HEC
- Humance
- IMC
- INT Evry
- Kaunas University of Technology
- Open University Netherlands
- Open University UK
- Tallinn University
- UC3M
- UMEA/Sweden
- University Jyväskylä
- University of Leicester
- University of Vienna

The represented ICOPER consortium partners were selected according to different criteria such as geographical coverage, size and type of the institution (e.g. (open) university, or company), as well as background (pedagogical experts with experience in technology-enhanced learning, ranging from 2 - 40+ years). The corresponding outcomes are presented in chapter 4.

Within Phase 3 (see Figure 2, p. 13), two (educational) expert focus groups were conducted in order to apply the validated process model of phase 2 in a) higher education, and b) vocational training settings. Based on this phase, a concrete guideline was formulated for both settings (see Table. 1, pp. 23 - 24). In so doing, higher education settings were represented by Saarland University (“IMS-LD as a potential eLearning standard for higher education settings”, held on the 5th of February 2010), and vocational training settings were represented by Festo Virtual Academy/Germany1 (“IMS-LD as a potential eLearning standard for corporate settings”, held on the 19th of February 2010).

It is important to mention:

- Both expert workshops were held to gather and share knowledge about hands-on-implementation-experience with IMS-LD compliant design (GLM) and delivery (integrated Clix ICOPER IMS-LD player) software. Hence, the feedback gathered at these two workshops supported us in adjusting the guideline towards more practicability.
- Regarding the kind of implementation at pilot partners, we decided to follow a cloud computing approach2 due to the following reasons:
  - Agility improves with users' ability to rapidly and inexpensively re-provision technological infrastructure resources [8].
  - Device and location independence enable users to access systems using a web browser regardless of their location or what device they use (e.g., PC, mobile).

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2 “Cloud computing is a way of computing, via the Internet, that broadly shares computer resources instead of having local servers handle specific applications” [24].
• Scalability via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time, without users having to engineer for peak loads. Performance is monitored and consistent and loosely-coupled architectures are constructed using web services as the system interface [12].
• Maintenance cloud computing applications are easier to maintain as they don't have to be installed on each user's computer. They are easier to support and to improve since the changes reach the clients instantly.
4 A Process Model for the Use of IMS Learning Design

In the following, a four-phase process model will be described which was derived based on the methodological underpinning exhaustively described in Chapter 3, and which, at the same time, patterns the guideline of Chapter 5. In so doing, the process model provides a systematic explanation and definition of those phases educators have to pass in order to apply IMS-LD successfully. More concrete, according to the process model, educators have to pass the following phases:

- Phase 1: Specification of the contextual requirements of the UoL,
- Phase 2: Design of the UoL by use of adequate IMS-LD editors,
- Phase 3: Delivery of the UoL by means of corresponding IMS-LD players, and
- Phase 4: Reuse of the UoL with the aid of an appropriate IMS-LD editor.

4.1.1 Phase 1 – specify contextual requirements

4.1.1.1 Target audience

An import aspect of the context specification is the definition of the target audience. Firstly, this is due to the fact that UoL designed in higher education settings might be completely different to those designed, delivered and reused in vocational training settings (see Table 1, p. 23). Thereby, the consideration of vocational training settings is due to the fact that higher education institutions such as business schools do more and more behave like vocational training providers. Thus, by integrating the vocational viewpoint, higher education settings are enabled to learn more about how to use IMS-LD from a vocational training perspective. In so doing, the integration of the vocational viewpoint is considered to contribute to a wider application and uptake of IMS-LD.

Secondly, with a view to the kind of educator who will be addressed, UoL designers have to be distinguished from UoL learning supporters (see Table 1, p. 23). Thereby, the separation of particular stakeholder groups has several important implications for the ongoing procedure: Whereas UoL designers are mainly addressed by the task to specify contextual requirements and design a UoL (see Table 1, p. 23: Phase 1-2), UoL learning supporters are involved in the tasks to deliver UoL and reuse UoL too (see Table 1, pp. 23 – 24: Phases 1-4).

4.1.1.2 Application target

For higher education settings, workshops revealed the following potential application areas (see Table 1, p. 23):

- IMS-LD as a means to generate, and structure ideas in general (e.g. in projects).
- IMS-LD as a means to provide mainstream offers (e.g. “introduction to marketing”), respectively so-called special offers (e.g. scarce/special subject such as “international marketing and/or rare formal trainings).
- IMS-LD as a means to support:
  - The management/organization of a blended learning offer,
  - Distance learning phases,
  - Work-experiences/co-op programs, and
  - “In-between-times” (e.g. supporting learners during semester break).

For vocational training settings, workshops revealed the following potential application areas (see Table 1, p. 23):

- IMS-LD as a means to design, and deliver product-/feature-oriented UoL (e.g.: Product training).
• IMS-LD as a means to design, and deliver job role-oriented UoL (e.g. “train-the-trainer”).

4.1.1.3 Unit of learning delivery mode

For higher education settings, workshops revealed the following potential UoL learning delivery modes, listed according to their relevance (see Table 1, p. 23):
• Blended learning (i.e. a blend of pure presence and distance learning),
• Pure presence learning, and
• Pure distance learning.

For vocational training settings, the following UoL learning delivery modes were found, likewise listed according to their relevance (see Table 1, p. 23):
• Blended Learning,
• Pure distance learning, and
• Social learning (i.e. focus on activities with a high level of interaction amongst learners as well as learners and learning supporters).

4.1.2 Phase 2 – design unit of learning

4.1.2.1 Design purpose

Based on the educators’ input, the following three design purposes emerged (see Table 1, p. 23):
• Rapid authoring by use of the GLM [13].
• Expert authoring and modification/reuse of any kind of IMS-LD compliant UoL by means of the Recourse LD editor [36].

4.1.2.2 Tool capability

How-to-use wizard

Based on educational experts’ input, educators should apply IMS-LD editors such as the GLM, or the Recourse IMS-LD editor as they more or less support the educator in designing an IMS-LD compliant UoL (see Table 1, p. 23).

Unit of learning template

Regarding UoL templates workshop participants required IMS-LD editors to feature ready-made templates of (see Table 1, p. 23):
• The organization/structure of a particular UoL (e.g. standardized teaching/learning strategies such as the supervision of a seminar, or a bachelor/master thesis).
• The content of particular UoL as initial starting point based on which the educator may design her UoL (“content is something very individual”).

IMS-LD level support

Whereas IMS-LD level A represents the design of a linear learning/teaching sequence, level B reflects an adaptive learning/teaching experience (see Table 1, p. 23). For example, based on learners’ progress level within a particular course, adequate/personalized (rich media) open educational content can be provided.

However, workshop participants neither deployed any kind of adaptivity nor required adaptivity as they considered it to be their central role in flexibly adapting the ongoing course (content) based on their students’ current progress level, etc.
Thus, educators should get familiar with IMS-LD level A, i.e. a linear learning/teaching sequence, firstly.

(Rich media) Open educational content support
Educators should integrate the following kinds of (rich media) open educational content as they were currently applied by most of the workshop participants, and at the same time are broadly supported by most of the IMS-LD editors, and players [28, pp. 71-75; see Table 1, p. 23]

- Flash videos,
- Text files (e.g. PDF, Word),
- WBTs, alternatively specified in IMS-CC or SCORM, and
- Web-content (URL).

Collaboration service support
The application of the subsequent collaboration services is recommended as these collaboration services appeared to successfully support educators in delivering IMS-LD compliant courses due to the following reasons (see Table 1, p. 23):

- Audio/Video conferencing\(^1\)
  - Enables face2face communication,
  - Facilitates socializing, i.e. prevents solitariness of learners,
  - Facilitates oral expressiveness.
- Forum:
  - +Scalable,
  - +Structured information, but requires guidance and organization from the educator,
  - +/-Causes “social pressure”.
- Virtual Classrooms, i.e. combinatorial tools which comprise:
  - Storage processing,
  - File sharing support,
  - One2one communication,
  - One2many communication (broadcasting),
  - Group communication,
  - Asynchronous communication (e.g. forum),
  - Synchronous communication (e.g. audio/video conferencing, chat).

UoL visualization
Educational experts required IMS-LD editors to provide the two following kinds of UoL visualization (see Table 1, p. 23):

- Graphical-oriented IMS-LD editors such as the GLM as this kind of learning design approach was considered to be highly intuitive, structured, flexible, and close to the educators’ background (e.g. modeling with concept maps, “playboard metaphor”). Thereby, standardized modeling notation approaches (e.g. Business Process Modeling Notation (BPMN [5]) and/or Event-driven Process Chains (EPC [9]) were considered to be a promising extension of IMS-LD.

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1 Regarding the selection of particular audio/video conferencing services, we strongly recommend to apply providers such as Flash Meeting [11] as they, as distinct from providers such as skype [37], enable learning/teaching “in-the-row”, i.e. the tool facilitates a “learning/teaching flow control” (one contributor/speaker at the same time).
• Answer-tree-oriented IMS-LD editors such as the Recourse LD editor as this kind of visualization best reflected the learning design mode educators are currently confronted, and thus familiar with.

4.1.3 Phase 4 – deliver unit of learning

4.1.3.1 Organizational embedment of the IMS-LD player

With a view to the organizational embedment of an IMS-LD player (see Table 1, p. 23) so-called integrated solutions (i.e. integrated into a Learning Management System) are separated from so-called standalone solutions (for further reading about the organizational embedment of IMS-LD players see: [28]).

Regarding integrated solutions, the following IMS-LD players are recommended [28, pp. 43-44]:

- Grail add-on in .LRN (e.g. applied by Universidad Carlos III de Madrid/Spain),
- Sled player [based on CopperCore] (e.g. applied by Open University Netherlands),
- Clix ICOPER IMS-LD player (IMC).

Concerning standalone solutions, the following IMS-LD players are recommended [28, pp. 43-44]:

- CopperCore (e.g. applied by Open University Netherlands),
- Smile player (applied by Centre for Research and Technology Hellas, Greece).

4.1.3.2 Tool capability

Unit of learning search, retrieval and import

Regarding UoL search, retrieval, and import support, educators required software developers to provide IMS-LD players with either a:

- Local (i.e. desktop-based), or
- Non-local (i.e. content repository-based).

search, retrieval, and import of IMS-LD, respectively learning outcome profile compliant, courses (see Table 1, pp. 23 - 24).

(Rich media) Open educational content support

Similar to Chapter 4.1.2.2, educators should apply integrated IMS-LD players such as the Clix ICOPER IMS-LD player as these players were found to support the widest range of (rich media) open educational content formats, amongst them: Flash videos, text files, SCORM-/IMS-CC-compliant WBT, and Web-content [28, p. 73; see Table 1, p. 24].

Collaboration service support

Similar to Chapter 4.1.2.2, educators should apply integrated IMS-LD players such as the Clix ICOPER IMS-LD player as such players were found to support the widest range of collaboration services, amongst them: Audio/Video conferencing, forum, and Virtual Classrooms (i.e. combinatorial tools) [28, p. 73; see Table 1, p. 24].

Learning-process-control support

Depending on the kind of learning-process-control support one can distinguish between linear, adaptable, and/or adaptive IMS-LD players [4, 39]. However, similar to Chapter 4.1.2.2, educators should focus primarily on IMS-LD level A while designing and delivering IMS-LD compliant courses (see Table 1, p. 24).
**UoL visualization**

Similar to Chapter 4.1.2.2 (UoL visualization during design time), educators should either apply graphical-oriented or answer-tree-oriented IMS-LD players as both kinds of visualization best reflected the kind of learning delivery mode educators are currently confronted, and thus familiar with (see Table 1, p. 24).

**Unit of learning annotation & enrichment (“UoL quality ensurance”)**

Regarding UoL quality ensurance, educators required an IMS-LD player to support the (see Table 1, p. 24):

- Annotation of a UoL (takes place at a “global” UoL level) as well as the
- Enrichment of a UoL (takes place at a “UoL activity level”).

As vocational trainings may be designed by external/professional content providers, the integration of the aforementioned functionalities can help educators to ensure high quality learning design and delivery as learners/learning supporters’ feedback (e.g. indicating problem with particular learning activities, etc.) might be directly integrated, respectively readout, of the UoL itself.

**Learning outcome profile management support**

In harmony with the efforts undertaken in WP2, educators required IMS-LD players to feature a learning outcome profile management support. Thereby, future IMS-LD players should encompass facilities to (see Table 1, p. 24):

- Easily administrate learners’ Learning Outcome Profile.
- Easily update learners’ Learning Outcome Profile.
- Flexibly convert learners’ Learning Outcome Profile according to the European Qualification Framework [10], IMS-ePortfolio [19], company-specific definitions of learning outcomes, etc.
- Easily publish learners’ Learning Outcome Profile in third party applications such as e-Portfolios, e-recruiting portals as well as social networks.

**Unit of learning recommendation support**

As distinct from educators’ missing need of an adaptive learning-process-control support, workshop participants required adaptivity (not IMS-LD level B) regarding the recommendation of particular UoL based on the learners’, respectively educators learning outcome profile (see Table 1, p. 24).

**4.1.4 Phase 4 – reuse unit of learning**

UoL templates are considered to be potential drivers of UoL reuse. Thereby, the UoL organization/structure (see Chapter 4.1.2.2: Standardized teaching/learning strategies such as the supervision of a seminar, or a bachelor/master thesis), as well as content-related recommendations (see Chapter 3.1.2.2) were found to be the two most relevant reference point for UoL reuse (see Table 1, p. 24).

Secondly, the IMS-LD editor’s capability was considered to be a further main driver for UoL reuse. Hence, the GLM is recommended in case the educator wants to reuse IMS-LD compliant courses designed with the Graphical Learning Modeller itself or the Recourse LD editor in case the educator intends to reuse UoL designed with the Recourse LD editor itself and/or other IMS-LD compliant editors such as the Graphical Learning Modeller (see Table 1, p. 24).
To conclude, the four dimensions of the process model (see Table 1, pp. 23-24) specify the tasks that educators should follow in order to apply IMS-LD successfully. The guideline presented in Chapter 5 therefore follows these tasks and provides a step-by-step guide on how to use IMS-LD.

In particular, an educator should use IMS-LD in four phases:

- Phase 1: Specification of the contextual requirements of the UoL,
- Phase 2: Design of the UoL by use of adequate IMS-LD editors,
- Phase 3: Delivery of the UoL by means of corresponding IMS-LD players, and
- Phase 4: Reuse of the UoL with the aid of an appropriate IMS-LD editor.

Thereby, the process model highlights in different colours:

- Those process model components which have already been realized in either current teaching practice or already implemented in current IMS-LD editors and/ or players will be considered (marked in light green), and
- Additionally, those process model components which will be realized in the realm of the ICOPER project are marked in dark green as they indicate future/potential enhancements of designing, delivering, and reusing a course by means of IMS-LD editors and/or players.

At the same time, the four-dimensional process model builds a comprehensive starting point for the subsequent Chapter 5. In so doing, each phase will be instantiated using the example of an IMS-LD compliant UoL which will be designed, delivered, and reused by means of best practice IMS-LD editors, and players.
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<td>UoL learning supporter</td>
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**Phase 4: Reuse UoL**

- Based on UoL templates
  - UoL organization/structure as an anchor point for UoL reuse
  - Content-related recommendations as an anchor point for UoL reuse
- Based on IMS-LD editor’s capability
  - Reuse is restricted to those UoL designed with the same editor
  - Reuse of any UoL edited with any IMS-LD compliant editor

**Tab. 1. Process model for the use of IMS-LD**
5 A Step-by-Step Guideline for the Use of IMS Learning Design

In the following, a four-phase step-by-step guideline for educators on how to specify, design, deliver and reuse IMS-LD compliant UoLs is provided. In so doing, the guideline is based on the four-phase process model described in the previous Chapter. Thus, educators who want to use IMS-LD as a means of designing, delivering and reusing UoLs are recommended to do this in four phases:

- Phase 1: Specify contextual requirements of the UoL,
- Phase 2: Design UoL,
- Phase 3: Deliver UoL, and
- Phase 4: Reuse UoL.

Hence, this guideline will help educators to better understand the entire IMS-LD design, delivery, and reuse process chain, and thus facilitate the successful application of IMS-LD within higher education and vocational training settings. Beyond, by use of the 4-tiered guideline, educators will be enabled to consider important aspects within the design of a course (e.g. the use of course templates within phase 2) which in turn may have a crucial impact on subsequent phases such as the reuse of these courses (phase 4).

As IMS LD is a computer-based method to design and deliver UoLs, tools are needed to support these tasks. This guideline recommends best-practice tools that turned out to best support each of the four phases. In so doing, educators who want to use the recommended tools thus can use this document as a kind of manual, whereas those educators who prefer to use other IMS-LD compliant tools can use the screens and explanations as reference samples in order to better understand the UoL design, delivery, and reuse process. Thereby, the following best practice tool configuration was chosen (Tab. 1, pp. 17 - 18):

- For the design of a UoL (Phase 2), the following IMS-LD editors were chosen as reference samples as they fulfill the most common needs:
  - **Graphical Learning Modeller** (freely available at: http://sourceforge.net/projects/prolix-glm/) as well as the

- For Phase 3 (UoL delivery), a Learning Management System or an IMS-LD player is needed that supports the requirements: For the guideline, the **integrated Clix ICOPER IMS-LD player** was chosen as this player renders IMS-LD compliant UoL, and is integrated into a Learning Management System that facilitates learning in higher education and corporate trainings.

- For Phase 4, the **Recourse LD editor** has been identified as best-practice as it offers a lot of possibilities to solve the tasks in this phase (freely available at: http://tencompetence-project.bolton.ac.uk/ldauthor/index.html).

The tool configuration used for the guideline represent just one possible tool configuration. Beside the tools presented above, any other IMS-LD editor/player that fulfills the requirements formulated in Chapter 4, respectively Table 1 (pp. 23 – 24) can also be applied.

After having worked through this Chapter, educators should be able to:

- Specify contextual requirements which are needed for the proper design, delivery, and reuse of an IMS-LD compliant UoL.
- Design an IMS-LD compliant UoL by means of two alternative best practice IMS-LD players.
• Understand how to deliver an IMS-LD compliant UoL in an integrated IMS-LD player.
• Reuse an IMS-LD compliant UoL by use of the best practice editor which enables the reuse of any IMS-LD compliant UoL.

5.1 Phase 1 - specify contextual requirements

The initialisation of the 4-tiered guideline starts with the specification of the contextual requirements. Thereby, the target audience, the application target as well as the UoL delivery mode have to be defined. In so doing, it is of big importance to consider the subsequent steps before starting to design, deliver, and/or reuse an IMS-LD compliant UoL as this phase turned out to have crucial impact on particular steps within subsequent phases (Tab. 1, pp. 17 - 18).

5.1.1 Target audience

Firstly, as particular phases differ between recommendations for:
• Higher education, or
• Vocational training,

it is of high importance to assign to either the higher education or the vocational training.

Hereafter, it is important to assign to one of the subsequent roles, namely:
• UoL designer, or
• UoL learning supporter.

This step is of big importance as UoL designers are mainly addressed by “phase 1 - specify contextual requirements” and “phase 2 – design UoL”, whereas UoL learning supporters are involved in “phase 3 – deliver UoL”, and “phase 4 – reuse UoL” as well (see Table 1, pp. 23 – 24).

5.1.2 Application target

This step provides an overview of potential application targets which might be facilitated by use of IMS-LD.

For higher education these are:
• IMS-LD as a means to generate, and structure ideas in general (e.g. in projects).
• IMS-LD as a means to provide mainstream offers (e.g. “introduction to marketing”), respectively so-called special offers (e.g. scarce/special subject such as “international marketing and/or rare formal trainings).
• IMS-LD as a means to support:
  • The management/organization of a blended learning offer,
  • Distance learning phases,
  • Work-experiences/co-op programs, and
  • “In-between-times” (e.g. supporting learners during semester break).

For vocational training these are:
• IMS-LD as a means to design, and deliver product-/feature-oriented UoL (e.g.: Product training).
• IMS-LD as a means to design, and deliver job role-oriented UoL (e.g. “train-the-trainer”).
5.1.3 Unit of learning delivery mode

This step should clarify which kind of learning delivery mode will be applied. In so doing, the following decisions have to be made:

In case of higher education, the subsequent UoL learning delivery modes might come into question (listed according to their relevance):

- Blended learning (i.e. a blend of pure presence and distance learning activities),
- Pure presence learning (e.g. for generating/structuring ideas), and
- Pure distance learning (e.g. supporting learners during semester break).

In case of vocational training, the following UoL learning delivery modes might come into question (listed according to their relevance):

- Blended Learning,
- Pure distance learning, and
- Social learning (i.e. focus on activities with a high level of interaction amongst learners as well as learners and learning supporters).
5.2 Phase 2 - design unit of learning

After having specified the contextual requirements, Phase 2 now deals with designing an exemplary IMS-LD compliant UoL. The UoL consists of the following activities:

Learning activities:
- Attend welcome meeting (e.g. to mutually decide on collaboration services which will be used in the whole UoL and/or particular activities),
- Study (SCORM-compliant) WBT,
- Play seller (within a role play),
- Receive feedback,
- Take online test.

Learning-supportive activities:
- Welcome learner
- Play customer (within a role play),
- Give feedback
As one can see on Table 2, the key differentiators of both editors are as follows:

Firstly, the GLM is highly appropriate when rapidly designing an IMS-LD compliant UoL based on a graphical-oriented design approach which contains high levels of (rich media) open educational content (see Table 2, p. 28).

As distinct from this, the Recourse LD editor is well-suited for experienced learning designers and/or supporters who strive for the design and/or reuse of highly compliant IMS-LD UoL based on a table-based design approach. Similarly to the GLM, the Recourse LD editor enables the integration of (rich media) open educational content (see Table 2, p. 28).

---

1 We strongly recommend to choose IMS-LD level A as most of the players are limited to level A (chapter 4.3)
2 IMS-CC-based Web-Based Trainings are currently not recommended to be included in a UoL as there is no IMS-LD player available in the market (as far as we know) which supports the primal goal of IMS-CC.
## 5.2.1 Design unit of learning with the Graphical Learning Modeller

In case one decides upon the GLM, the following steps have to be passed in order to create the exemplarily UoL (see Table 3):

<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Create learning design.</td>
<td>Fig. 3, p. 30</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Start learning design.</td>
<td>Fig. 4, p. 30</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Create learning activity</td>
<td>Fig. 5, p. 31</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Match learner role to learning activity.</td>
<td>Fig. 6, p. 31</td>
<td></td>
</tr>
<tr>
<td>5. / 6.</td>
<td>Create learning support activity and match learning supporter role to this learning support activity.</td>
<td>Fig. 7, p. 32</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Synchronize learning/support activity.</td>
<td>Fig. 8, p. 33</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Add collaboration service to learning/support activity.</td>
<td>Fig. 9, p. 33</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Add linked flash video (URL) to learning activity.</td>
<td>Fig. 10, p. 34</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Add embedded flash video (file) to learning activity.</td>
<td>Fig. 11, p. 34</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Add SCORM WBT to learning activity</td>
<td>Fig. 12, p. 35</td>
<td></td>
</tr>
<tr>
<td>12. / 13.</td>
<td>Add linked collaboration service (URL) to learning activity.</td>
<td>Fig. 13, p. 35</td>
<td>Fig. 14, p. 36</td>
</tr>
<tr>
<td>14. / 15.</td>
<td>Add online test to learning activity.</td>
<td>Fig. 15, p. 36</td>
<td>Fig. 16, p. 37</td>
</tr>
<tr>
<td>16.</td>
<td>Generate valid UoL</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

As one can see on Table 3, the first step is the creation of a new Learning Design (see Figure 3, p. 30):
Fig. 3. Create learning design (GLM)

Next, a so-called UoL starting point has to be inserted into the workspace in order to initialize the UoL design process (see Figure 4):

Fig. 4. Start learning design (GLM)

In the third step, a learning activity has to be created via drag and drop on the right-hand workspace (see Figure 5, p. 31):
In the fourth step, the learner role (here: Orange-coloured) has to be matched to the corresponding learning activity via drag and drop on the upper left-hand workspace (see Figure 6):
Similarly to the two aforementioned steps, a corresponding learning support activity (here: Grey-coloured) has to be created (see Figure 7):

![Fig. 7. Match learning supporter role to support activity (GLM)](image)

Next, the learning and supporting activity have to be synchronized via drag and drop on the upper right-hand workspace where one has to select a connection arrow. This connection arrow links the starting point with the two subsequent learning, and learning support activity which in turn are synchronised in a so-called synchronisation point so that the system automatically initiates a new (learning and/or support) activity in case both preceding activities were completed (see Figure 8, p. 33):
During step eight (see Figure 9), a collaboration service (here: Forum) has to be added to the second learning as well as to the second learning support activity which are created according to the instructions of step 3-7. In so doing, one has to specify the user permissions of the learner, and the learning supporter (here: Participant vs. observer):
In step nine (see Figure 10), a linked flash video (URL) is added to the second learning activity:

![Add linked flash video (URL) to learning activity (GLM)](image)

In addition to adding Web-content (=URLs) to an activity, the GLM allows to add physical files (here: Flash video) to the first learning activity (see Figure 11):

![Add flash video (file) to learning activity (GLM)](image)
In step eleven (see Figure 12), a SCORM WBT is added to the second learning activity. Additionally, the learner is provided with additional information about the upcoming role play which will take place in learning activity three by use of a virtual classroom (see Figure 13: Adobe Virtual Classroom [3]):

![Fig. 12. Add SCORM WBT to learning activity (GLM)](image)

In step twelve, the virtual classroom (here: Adobe Virtual Classroom [3]) is added to the third learning activity (see Figure 13). In so doing, both, the learner, and the learning supporter are enabled to conduct the upcoming role play (learner = seller; learning supporter = customer):

![Fig. 13. Add linked collaboration service (URL) to learning activity (GLM)](image)
ISURE: Guideline for the integration of instructional models with open educational content in IMS Learning Design

Additionally, particular role play-related instructions have to be provided so that each learner exactly knows what is expected from her to do within this role play (see Figure 14):

In step fourteen and fifteen, an online test is added to the last learning activity. The test itself is featured by the GLM (see Figure 15):

Fig. 14. Add linked collaboration service (URL) to learning activity- activity description (GLM)

Fig. 15. Add online test to learning activity (URL)
In so doing, the GLM allows to specify the amount of questions to be defined during runtime as well as the number of possible answers per question (see Figure 16):

![Add online test to learning activity (GLM)](image)

**Fig. 16. Add online test to learning activity (GLM)**

In order to generate a valid, i.e. IMS-LD compliant, UoL, one has to press on the corresponding button on the lower left-hand side.
### 5.2.2 Design unit of learning with the Recourse LD editor

In case one decides upon the Recourse LD editor, the following steps have to be passed in order to create the exemplarily UoL (see Table 4):

<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. / 2.</td>
<td>Create learning design.</td>
<td></td>
<td>Fig. 17, p. 39</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fig. 18, p. 39</td>
</tr>
<tr>
<td>3.</td>
<td>Specify learning design.</td>
<td></td>
<td>Fig. 19, p. 40</td>
</tr>
<tr>
<td>4.</td>
<td>Store learning design in library.</td>
<td></td>
<td>Fig. 20, p. 40</td>
</tr>
<tr>
<td>5.</td>
<td>Create module/play.</td>
<td></td>
<td>Fig. 21, p. 41</td>
</tr>
<tr>
<td>6.</td>
<td>Create learning activity.</td>
<td></td>
<td>Fig. 22, p. 41</td>
</tr>
<tr>
<td>7. / 8.</td>
<td>Match learner role to learning activity.</td>
<td></td>
<td>Fig. 23, p. 42</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fig. 24, p. 42</td>
</tr>
<tr>
<td>9.</td>
<td>Create support activity / generate act.</td>
<td></td>
<td>Fig. 25, p. 43</td>
</tr>
<tr>
<td>10. / 11.</td>
<td>Create environment.</td>
<td></td>
<td>Fig. 26, p. 43</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fig. 27, p. 44</td>
</tr>
<tr>
<td>12.</td>
<td>Match SCORM WBT to learning activity.</td>
<td></td>
<td>Fig. 28, p. 44</td>
</tr>
<tr>
<td>13.</td>
<td>Match collaboration service to learning activity.</td>
<td></td>
<td>Fig. 29, p. 45</td>
</tr>
<tr>
<td>14.</td>
<td>Generate valid UoL.</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

**Tab. 4. Designing a UoL with the Recourse LD editor – steps overview**
As one can see on Table 4 (p. 38), the first step one has to undertake is the creation of a new Learning Design (see Figure 17):

![Creating learning design (Recourse LD editor)](image)

In so doing, one can choose between empty, basic, and cloned Learning Designs. As we intend to create a completely new Learning Design, one has to choose the first option (see Figure 18):

![Create learning design (Recourse LD editor)](image)

In step three, the Learning Design has to be further specified by indicating the title, learning objectives as well as the prerequisites of the UoL (see Figure 19, p. 40):
After having specified the UoL it is displayed as a new item in the UoL library on the right-hand side of the workspace (see Figure 20):
Fig. 21. Create module/play (Recourse LD editor)

After having initiated the module/play the editor allows the user to design the first learning activity (see Figure 22: “Attend meeting”):

Fig. 22. Create learning activity (Recourse LD editor)

In step seven and eight, the editor requires the user to match the learner role to the corresponding learning activity (see Figure 23, p. 42: “Attend welcome meeting”):
Fig. 23. Match learner role to learning activity (Recourse LD editor)

In so doing, the Recourse LD editor supports the user in further specifying the corresponding role type (see Figure 24):

Fig. 24. Match learner role to learning activity (Recourse LD editor)

In step nine (see Figure 25, p. 43), the first support activity has to be designed (“welcome learner”) by matching it to the appropriate learning activity (“attend welcome meeting”). In so doing, one creates a so-called “act” (i.e. a sequence of activities which substantially belong to each other). Its successful completion by the learner then initialises the subsequent learning/support activities:
In order to match learning resources and/or collaboration services to corresponding learning and/or support activities successfully, one has to switch to the “environment workspace” (step 10). There, one can create an environment template via drag and drop on the upper right-hand workspace (see Figure 26, p. 43):

In the subsequent step, one can flexibly match the required learning resources (e.g. SCORM WBT) and/or collaboration services (e.g. forum) to either a single or specific learning environment (step eleven; see Figure 27, p. 44). As a consequence, the editor enables the user to reuse particular “(configurations of) environments” in a succeeding learning and/or support activity:
Fig. 27. Create environment (Recourse LD editor)

After having created an environment, one can match the SCORM WBT (see Figure 28) as well as the forum (see Figure 29, p. 45) to the corresponding learning/supporting activity via drag and drop on the lower workspace:

Fig. 28. Match SCORM WBT to learning activity (Recourse LD editor)
In the final step, a valid, i.e. IMS-LD compliant, UoL, has to be created.

5.3 Phase 3 - deliver unit of learning

After having designed the exemplary UoL, phase 3 now deals with delivering this UoL.

<table>
<thead>
<tr>
<th>Feature/Player</th>
<th>Integrated Clix ICOPER IMS-LD player</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organizational embedment</strong></td>
<td></td>
</tr>
<tr>
<td>Integrated</td>
<td>x</td>
</tr>
<tr>
<td>Standalone</td>
<td></td>
</tr>
<tr>
<td><strong>Tool capabilities &amp; recommendations</strong></td>
<td></td>
</tr>
<tr>
<td>Learning-process-control support</td>
<td>A-B</td>
</tr>
<tr>
<td>(Rich media) Open educational content support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Flash Video</td>
</tr>
<tr>
<td></td>
<td>• IMS-CC WBT(^1)</td>
</tr>
<tr>
<td></td>
<td>• SCORM WBT</td>
</tr>
<tr>
<td></td>
<td>• Text files (e.g. Excel, PDF, Word)</td>
</tr>
<tr>
<td></td>
<td>• Web-content (URL)</td>
</tr>
<tr>
<td>Collaboration service support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Audio/Video Conference (e.g. Flash Meeting)</td>
</tr>
<tr>
<td></td>
<td>• Forum</td>
</tr>
<tr>
<td></td>
<td>• Virtual Classroom (e.g. Adobe Virtual Classroom)</td>
</tr>
<tr>
<td>UoL visualization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Graphical-oriented</td>
</tr>
<tr>
<td></td>
<td>Answer-tree-oriented</td>
</tr>
</tbody>
</table>

Tab. 5. Best practice IMS-LD player - overview

\(^1\) IMS-CCs are currently not recommended to be included in a UoL as there is no IMS-LD player available in the market (as far as we know) which supports the primal goal of IMS-CC.
Thereby, the UoL delivery phase will be illustrated by means of the integrated Clix ICOPER IMS-LD player as it turned out to support most of the educators’ requirements (see Table 5, p. 45). In so doing, the following steps have to be passed (see Table 6):

<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Search, and retrieve UoL.</td>
<td>Fig. 30, p. 47</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Import UoL.</td>
<td>Fig. 31, p. 47</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Import role-mapping.</td>
<td>Fig. 32, p. 48</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Initiate UoL instantiation.</td>
<td>Fig. 33, p. 48</td>
<td></td>
</tr>
<tr>
<td>5. / 6. / 7.</td>
<td>Instantiate UoL.</td>
<td>Fig. 33, p. 48, Fig. 34, p. 48, Fig. 35, p. 49, Fig. 36, p. 49</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Learner administration.</td>
<td>Fig. 37, p. 50</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Learner course entry point.</td>
<td>Fig. 38, p. 50</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Answer-tree-based visualization of learning delivery.</td>
<td>Fig. 39, p. 51</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Execute learning activity.</td>
<td>Fig. 40, p. 51</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Provide feedback on UoL activity-level.</td>
<td>Fig. 41, p. 52</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Complete/Finish course.</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Tab. 6. Delivering a UoL with the Clix ICOPER IMS-LD player – steps overview
As one can see on Table 6 (p. 46), the first step one has to undertake is the search, and retrieval of a UoL (see Figure 30). In so doing, Figure 30 exemplarily depicts the local, i.e. desktop-based, search, and retrieval of the IMS-LD compliant example UoL.

![Fig. 30. Search for and retrieve unit of learning (Clix ICOPER)](image)

By pressing the “import LD” button (step 2), a new page is opened which provides a corresponding upload functionality of (non-)local IMS-LD compliant UoL (see Figure 31):

![Fig. 31. Import unit of learning (Clix ICOPER)](image)

After having successfully uploaded the UoL, the system requires to map the roles specified in the UoL to those provided by Clix ICOPER (see Figure 32, p. 48):
In step four (see Figure 33), the UoL has to be instantiated in order to create a regular course. In so doing, one has to follow the click stream Content management > Courses > Course management firstly, and then has to press the “create” button, located on the upper left-hand side of the workspace in order to start the UoL instantiation procedure (see Figure 33):

In order to successfully instantiate the UoL (step 5), one has to choose the course language (see Figure 33) followed by the selection of the learning platform (see Figure 34: Blended learning) as well as the course type (see Figure 34):
During step six, adequate course instance parameters such as the course title, course description, course start date, course end date as well as the planning status have to be set (see Figure 35):

**Course manager**

Create: Business English 3

![Image](Instantiate UoL – step3 (Clix ICOPER))

Regarding the “planning status” (step 7), one has the following options: In case the “planning status” is locked, no learner can run the course, whereas the course is made available to the assigned learners in case the “planning status” is changed to released (see Figure 36):

![Image](Instantiate UoL – step4 (Clix ICOPER))
In step eight, learners can be assigned to courses (=UoL) either via the course manager or the participant administration. In both cases, a course has to be selected to assign potential participants to it. This is done by pressing the “members” button firstly available at the top navigation bar. By selecting the “add” button at the participants’ list after that, a new window depicts already registered learners who then can be matched to the course under consideration (see Figure 37).

After having set up the UoL, step nine depicts the learner course entry point. Thereby, the learner starts her UoL by selecting the “syllabus” button in the upper navigation bar (see Figure 38):

Once the learner has started her UoL, she has access to those learning activities specified in the UoL design phase (see Chapter 5.2). Thereby, the learning activities are alternatively visualized in the shape of an answer tree (see Figure 39, p. 51):
Fig. 39. Answer tree-based visualization of learning delivery (Clix ICOPER)

or in the shape of a so-called activity graph which is mainly based on the standardised BPMN [5] (see Figure 40):

Fig. 40. Execute learning activity (Clix ICOPER)

As a consequence, learner and learning supporter do interact on a very transparent level. Thereby, current learner-/learning supporter-related activities are indicated with an orange border around the actual activity rectangle. Within each activity rectangle those activity-related information specified during the UoL design phase (see Chapter 5.2) are provided. (see Figure 40). Beside textual information provided within each activity rectangle, they additionally supply the learner/learning supporter with icon-based information, whereas the corresponding number aside each icon either represents the:
• Number of learners that have (already) started this activity
• Number of learners that have successfully finished this activity.

Beyond (step twelve), in addition to a “system-generated provision of information”, Clix ICOPER enables the learner/learning supporter to actively provide/generate information on a UoL activity-level, i.e. to undertake a UoL enrichment (see Figure 41):

Finally, the learner finishes her course by selecting the “complete course” button.

5.4 Phase 4 - reuse unit of learning

After having designed and delivered the example UoL (see Chapter 5.2 – 5.3), Phase 4 now deals with reusing the example UoL. Thereby, the reuse of an existing UoL may come into consideration in case a particular UoL has to be slightly modified in the following semester, respectively corporate training, based on emerging requirements (e.g. new learning materials and/or collaboration services needed).

In so doing, Phase 4 again is supported by the Recourse LD editor (freely available at: http://tencompetence-project.bolton.ac.uk/ldauthor/index.html). The selection of this editor is due to the fact that it enables the reuse of any IMS-LD compliant UoL edited with the Recourse LD editor itself as well as any other IMS-LD compliant editor (e.g. GLM).

As one can see on Figure 42 (p. 53), the Recourse LD editor accurately renders the learning/support activities, respectively acts (here: “Welcome learner” – “attend welcome meeting”).
meeting”,; “study Web-Based-Training”; “play seller - play customer”; “give feedback-receive feedback”; “take online test”) originally designed with the GLM (see Chapter 5.2.1) as well as with the Recourse LD editor itself (see Chapter 5.2.2):

As the reuse of an IMS-LD compliant UoL by use of the Recourse LD editor is similar to its design, we kindly refer to Chapter 5.2.2 for further reading about how to design/modify an IMS-LD compliant UoL by means of the Recourse LD editor.
6 Conclusions

IMS-LD as specification for instructional design will only be used on a broad level, if the process chain for design, delivery, and reuse is being understood on a general level of educators across higher education institutions. This guideline will contribute to this and shall be seen as a starting point to raise the discussion of what is needed and has to be done by educators to make use of IMS-LD.

The following results have been achieved with this ISURE:

- open educational content as well as IMS-LD as a means to integrate instructional models with open educational content were presented.
- a process model was derived which patterned the execution of the guideline.
- an exemplary IMS-LD compliant course was designed, delivered, and reused by means of best practice IMS-LD editors, and players.

In so doing, educators from higher education and corporate training settings learned more about what to consider when designing, delivering and/or reusing an IMS-LD compliant course.

Such a guideline must be seen as a starting point of the discussion and not as the end. It will be an ongoing task to ground the guideline with further practical experiences, release them in documents and papers and work further experiences into them. By this, the goal is to contribute to a wider application and uptake of IMS-LD in general and especially within the higher education segment in first instance and vocational training area in second instance.

Further research is recommended:

- For educators it will be very helpful to offer them “standardized UoL visualizations” for learning design and delivery based on successfully applied business modelling notations such as BPMN [5] or EPC [9]. The semantics of the modelling methodology of IMS-LD can be improved, as experience with the understanding of the methodology shows. This is due to the fact that these notations are main drivers towards a common understanding of UoL designs, which in turn may foster UoL reuse. Thus, in the realm of the ICOPER project WP5 will further elaborate this issue.
- IMS LD has to better support collaboration services within the IMS-LD editors and players. Further research has to be done within this area and will be part especially of ICOPER work. This means, that the corresponding application profile for IMS-LD collaboration services must be improved. An expert Delphi approach will be chosen to do this, coupled with expert focus groups [7, 14, 35, 38].
- The guidelines will be evaluated by use of ICOPER-specific prototypes, which will be (further) developed and evaluated in the upcoming period.

All these activities in the end will lead to an increased use of IMS LD within higher education as specification for learning design and delivery.
7 References


