

## Transposing MISA Learning Scenarios into IMS Units of Learning

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### Abstract:

This paper reports an exploratory study investigating the transposition process of a course called the Black Box into a Unit of Learning (UoL), characterized by its collaborative and multi-actor distance learning scenario. It was graphically represented by using the MOT software used in the MISA Instructional Engineering Method. To transpose this scenario into an IMSLD UoL, the iterative nature of this study helped develop the MOT+LD editor and an IMSLD Graphical Representation Code (GRC) now embedded in the editor.

The study showed that the MISA method and Level A of the IMSLD Specification share several conceptual elements and representations that accentuate their complementarity in a coherent and clear manner. This finding is very encouraging to extend the analysis of levels B and C of the specification and adapt the MISA method to ease the construction of fully interoperable IMSLD UoL.

**Keywords:** Instructional Design; IMS Learning Design; IMSLD Editors; Units of Learning; Learning Objects; Standards

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## 1 Introduction

Since the release of the final draft in 2003, the IMSLD Specification has drawn the attention of many researchers interested in interoperability and reusability of learning scenarios (or UoL pedagogical structure). Even though this specification answers the need to formalize the representation of learning scenarios and to provide a set of machine interpretable metadata to assure interoperability, it is an understatement that the notational language used is not easily understood by course designers, nor is it meant to be.

In view of these facts, numerous research initiatives have concentrated on developing tools to facilitate the production of IMSLD compliant UoL (Griffiths, Blat, Garcia and Sayago, 2004). In general, these research initiatives focus on the design of courses, where the intention is from the start to make them interoperable. Up until now, very few attempts have been done to transpose existing learning scenarios into interoperable units of learning. This study aimed at understanding what is needed to elaborate a transposition methodology capable of assisting in the design of generic, sharable models representing 'good design' as stated by McAndrew & Weller (2005) as necessary to encourage reusability.

Transposition from a source to a target model implies that there exists some type of equivalences at least at the conceptual level between the two frameworks. An existing pedagogical scenario designed with MISA method (Paquette, 2003) has a lot of similarities (activity flow, actors and resources) with an IMSLD UoL, and was therefore chosen as the source document for the transposition, while the IMSLD UoL is the target.

In the MISA method, graphical modeling with the MOT+ modeling software (Paquette, 2002) is used to build models of the knowledge and competencies, the pedagogical structure, the description of support material and the delivery processes. In order to establish common points of references at the graphical level, the project started out by developing a representational graphical code (RGC) in MOT+ including all concepts inherent in the IMSLD specification. This was an essential step to create a coherent modeling syntax and semantics for the transposition process.

The following objectives were then established:

- a. Examine the advantages and shortcomings of the IMSLD specification in comparison with a model developed using the MISA method.
- b. Identify possibilities and limits to the IMSLD editor version of the MOT+ software in regards to the needed functionalities.
- c. Validate the Representational Graphical Code (RGC) proposed by the development team as the basis for the MOT+LD editor.

- d. Transpose an existing pedagogical scenario into a IMSLD Level A compliant Unit of Learning manifest and graphical model.
- e. Develop a methodological guide for the course designer, who wishes to produce IMSLD conformant Learning Scenarios (Units of Learning).

## 2 A Graphical Representation Code for IMSLD

To date, there is no formal instructional design method assisting the course designer with the transposition of existing scenario into a IMSLD Unit of Learning, although the IMSLD Best Practices guide suggests to start with a structured narrative including an identification of most of the basic concepts, such as prerequisites, learning objectives, the roles involved, the learning objects and services needed in the learning environment, etc...

In general, it is recognized that the IMSLD specification is complex and that a course designer requires support tools, both methodological and technical, to successfully implement the specification (Milligan, 2004; Koper & Olivier, 2004; Olivier, 2004).

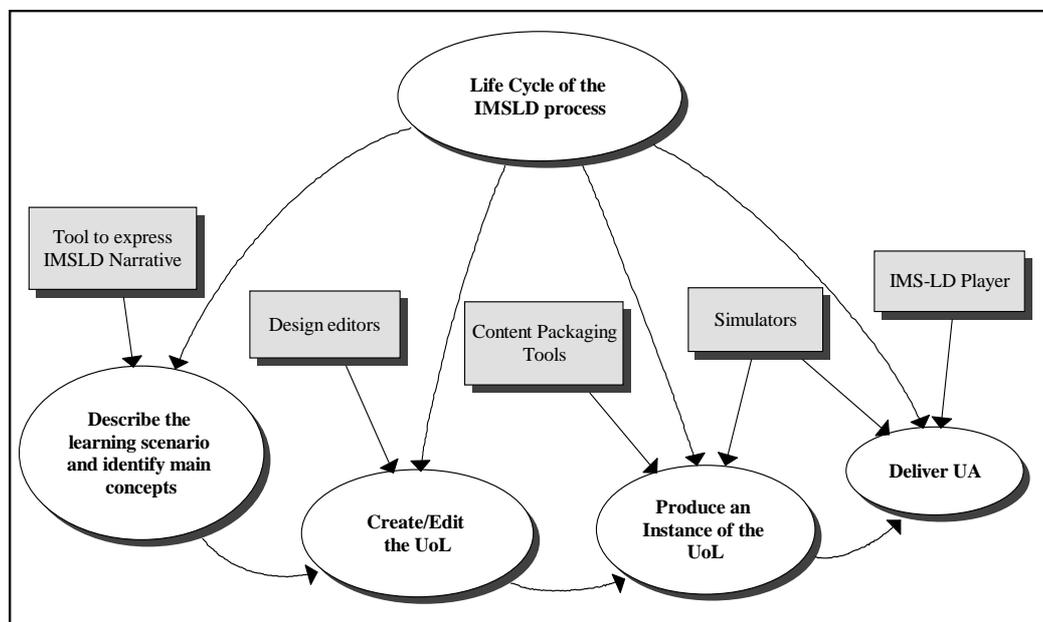


Figure 1: Unit of Learning Design process Life Cycle and needed support tools (grey).

As shown in figure 1, four main processes constitute the life cycle of a UoL. Starting with

the narrative description of the UoL scenario, the course designers' work might be facilitated by using a template or interactive forms guiding the main steps into including all the basic concepts that must be clear before starting the production of the UoL. The result of this step is a concise narrative and an activity diagram. Secondly, the IMSLD XML file has to be created by an editor, and then passed to another tool capable of appropriately packaging physical files and metadata records, thus producing a manifest. The manifest will serve two purposes, one to simulate the design in order to verify all features and to detect eventual errors. Once a manifest is error free, it needs a Player or Learning Content Management System capable of delivering multi-actor designs.

For the two first processes in the life cycle, the MISA Instructional Engineering Method provides the methodological framework to describe UoL and the MOT+ editor ensures a coherent graphical representation, thus confirming compatibility with the IMSLD perspective, concepts and ideas.

Before developing the MOT+LD editor supporting the construction of a UoL, it was important to develop the syntax and semantics of a Graphical Representational Code (GRC) providing a set of graphical objects with which the models of the UoL could be built. At the LICEF research centre, this work was carried out during several research projects such as eduSource [1], R2R [2] and LORNET [3].

MOT+LD model and MOT+XML specifications for Level A (Léonard & Lundgren-Cayrol, 2004)					
LD Concept <sup>1</sup>	MOT+ Symbol <sup>2</sup>	MOT+ graphic constraints <sup>3</sup>	MOT+XML useful for parsing	Parsing specifications	XML-LD examples
Act		At least, one of these symbols is obligatory in the main model. If there us more than one Act, then always performed in sequence (P-link) Always has a sub-model containing one or more Activities or references to 'Activity Structures' or other Units of Learning describing the role-parts. If a 'complete-act time-limit condition' is chosen then the designer can R-link a ' <b>Complete Statement</b> ' to the play symbol.	MODEL id="Domain1Model1" name="Main model"  NODE id ="Domain1ActNodeID"  name="Act name"  type="Act"  C Link	<b>"True" conditions, symbol:</b> <ul style="list-style-type: none"> <li>Is in the Main Model</li> <li>Has only one ingoing C link</li> <li>Has no outgoing C links</li> <li>Has a sub-model</li> <li>0 or 1 outgoing P link</li> <li>Has 0 or 1 ingoing R link from a '<b>Complete Statement</b>'</li> </ul> <p>The 'Act identifier' is defined by the node ID of this symbol                      The 'Act title' is defined by the text in this symbol                      If Acts are numbered by the designer, the parser uses the numbers (1 -n) to sequence the acts in the XML.                      The Act's role-parts are derived from each Role and Activity within</p>	<act> <act identifier="Domain1ActNodeID"> <title>Act name</title> <role-part>  </role-part> <complete-act> <PnYnMnDTrnHnMnS/> </complete-act> </act>

Figure 2: The Graphical Representational Code for the Act concept

For each IMSLD concept, such as an "Act" (figure 2), a MOT+ symbol was chosen, and its main constraints described. Then the MOT+ xml schema and main parsing specifications

were identified to facilitate the programming of a parser from MOT+ native XML to the IMSLD XML file, followed by a known IMSLD xml example to demonstrate what the final xml code must look like. Moreover, the grammar for each type of link was clearly identified. Figure 3 shows the syntax to be used for the composition (C) link and the input/product (IP) links (learn more at [http://206.167.88.22:90/cice/pdf/IMSLD\\_050516.pdf](http://206.167.88.22:90/cice/pdf/IMSLD_050516.pdf) ).

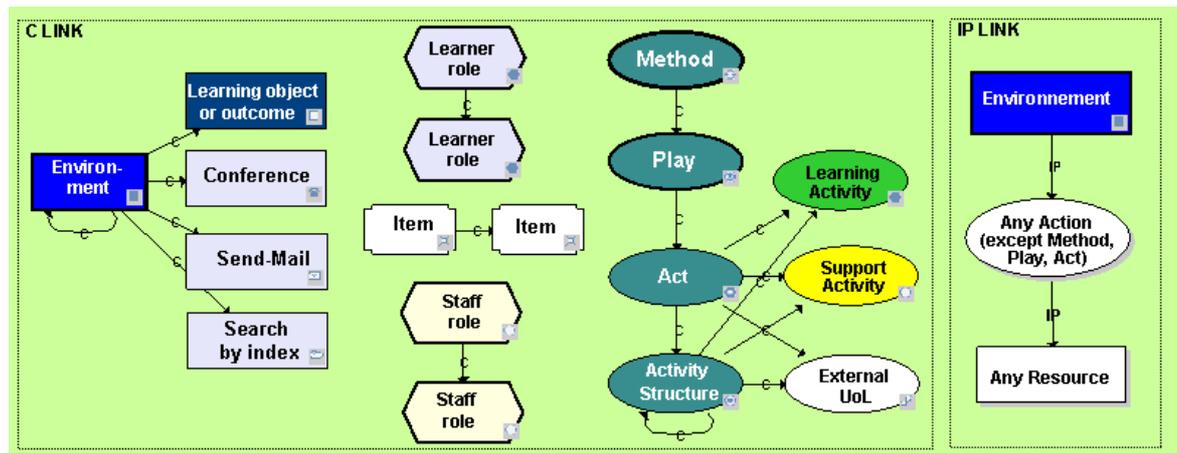


Figure 3: How to use the MOTPlus C-link and P-link

### 3 The Transposition Process

The transposition process used in this study was structured around three steps: Generation of the original model, Validation and Revision of the model which are conducted through repeated cycles. Application of an iterative approach allowed each team to make revisions to their products and provide feedback to other teams. This procedure is illustrated in figure 4.

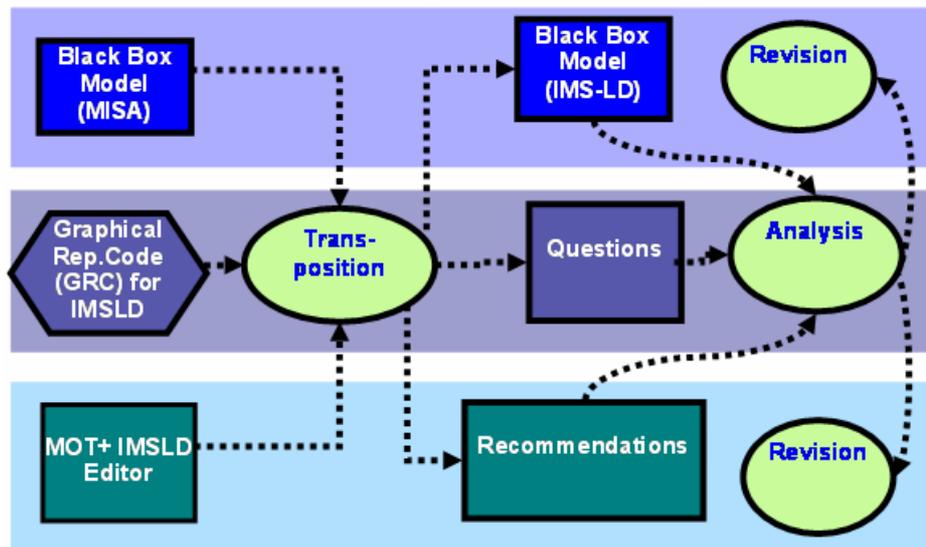


Figure 4: Procedure of the transposition process

The objects on the left part of the schema show the three initial materials: a Graphical model of the Black Box (Couture & Ruelland, 2004) course scenario, Graphical Representation Code of IMSLD concepts (GRC), and the MOT+LD editor. The "Transposition" oval refers to the process leading to the generation of a first IMSLD graphical model of the Black Box course as well as to a list of questions and recommendations. The "Analysis" oval corresponds to the Validation step, and the "Revision" oval refers to the integration of the results ensuing from the Analysis done on the initial materials into its subsequent versions. The following table synthesizes this process.

	<b>Tasks</b>	<b>Participants</b>	<b>Results</b>
<b>Step 1 Generation</b>	A preliminary IMSLD version of the existing learning scenario model was created.	Instructional Designer having necessary expertise to read the MISA model of the Black Box learning scenario, initiated to the GRC semantics and comfortable using MOT+ software.	A graphical model of the Black Box learning scenario a first version of a conformant UoL.  Documentation of questions and ambiguities.  Recommendations.
<b>Step 2 Validation</b>	Analysis of the preliminary model by clarifying questions and ambiguities concerning the CRG as well as the IMSLD concepts raised during the generation of the previous model.	Conceptual developers of the GRC and the MOT+ LD programmers.	Important clarifications of the IMSLD ambiguities, answers and solutions to questions.
<b>Step 3 Revision</b>	Adjustment to the CGR and the editor according to data provided during the Validation Step.	Conceptual developers of the GRC and the MOT+ LD programmers.	A MOT+ v.7.5 IMSLD compliant model  A MOT+ v.1.4.2 IMSLD model, manifest and html simulation.

*Table 1: Transposition Steps*

## 4 Analysis and Results of the Study

### 4.1 Generation of the IMSLD graphic model from a MISA model

The questions and comments resulting from this step highlighted the fact that a learning scenario designed with MISA focuses only on the pedagogical structure, because in this method, the media and delivery issues are represented by different models. However, it became evident that it was essential to integrate the pedagogical, media and delivery issues in the same model in order to elaborate a complete IMSLD model. The result of this

modeling attempt is that a MISA pedagogical model is not sufficient to elaborate a Unit of Learning.

The main question that emerged in this step can be summarized as follows: Does the IMSLD specification cover enough pedagogical situations of collaboration like those included in the Black Box scenario model? It was difficult to represent the collaborative activities, the manner in which the actors should be working in teams, and how outputs from each activity were used in other activities.

At first glance, the representation difficulties suggested limits to the IMSLD specification. A deeper consideration of the question suggested that this weakness was due to the fact that the representation code covered only level A. A thorough study of the Learning Design Model Information document (IMSLD, 2003) revealed that certain problems could be tackled in level A, but that the GRC had to be enhanced to include level B and C.

During the Validation process the GRC satisfied the requirement for representing an IMSLD compliant pedagogical model elaborated according to the MISA method. Minor revisions to the GRC were recommended in order to elucidate certain details intended to help the MOT+LD editor developers, as well as the parser's programmer.

In general, the revisions necessary to the code according to the experiment were minimal. However, the second cycle revealed some of the concepts and elements missing from the GRC, such as for example, how to assign maximum and minimum number of persons to a role.

The difficulties encountered during the development of the IMSLD graphical model demanded solutions at both pedagogical and technical levels. For example, the graphical code permits representing an environment shared by two actors, thus forming two role-parts, which the parser had to recognize in order to make the XML file IMSLD compliant.

At this step, the multi-labelling solution tried initially proved to be a cumbersome operation, and to tackle that problem, a number of new objects were added to the MOT+LD editor, as shown on figure 3. This is the case for the sub-types of each service: Conference, Send-Mail, and Index-Search. For example, for the Conference service an object was created for each of the following sub-types: Synchronous, Asynchronous and Announcement.

As much as possible, the MOT+LD editor developers have tried to use the MISA representational syntax in order to keep coherence with the designer's methodology and to make the IMSLD concepts and syntax transparent. However, certain graphical representations are still complicated, as for example Conference and Send-Mail services.

During the revision procedure, new graphical objects were added and certain constraints on links between objects were removed in order to better respond to conditions required by the IMSLD specification. Among the new graphical objects can be mentioned the Learning Object and the Environment symbols. The concept of an environment is not present in the

pedagogical model of MISA, but is considered while constructing the delivery model. Finally, the following two figures show the resulting model of the "Boîte Noire" UoL.

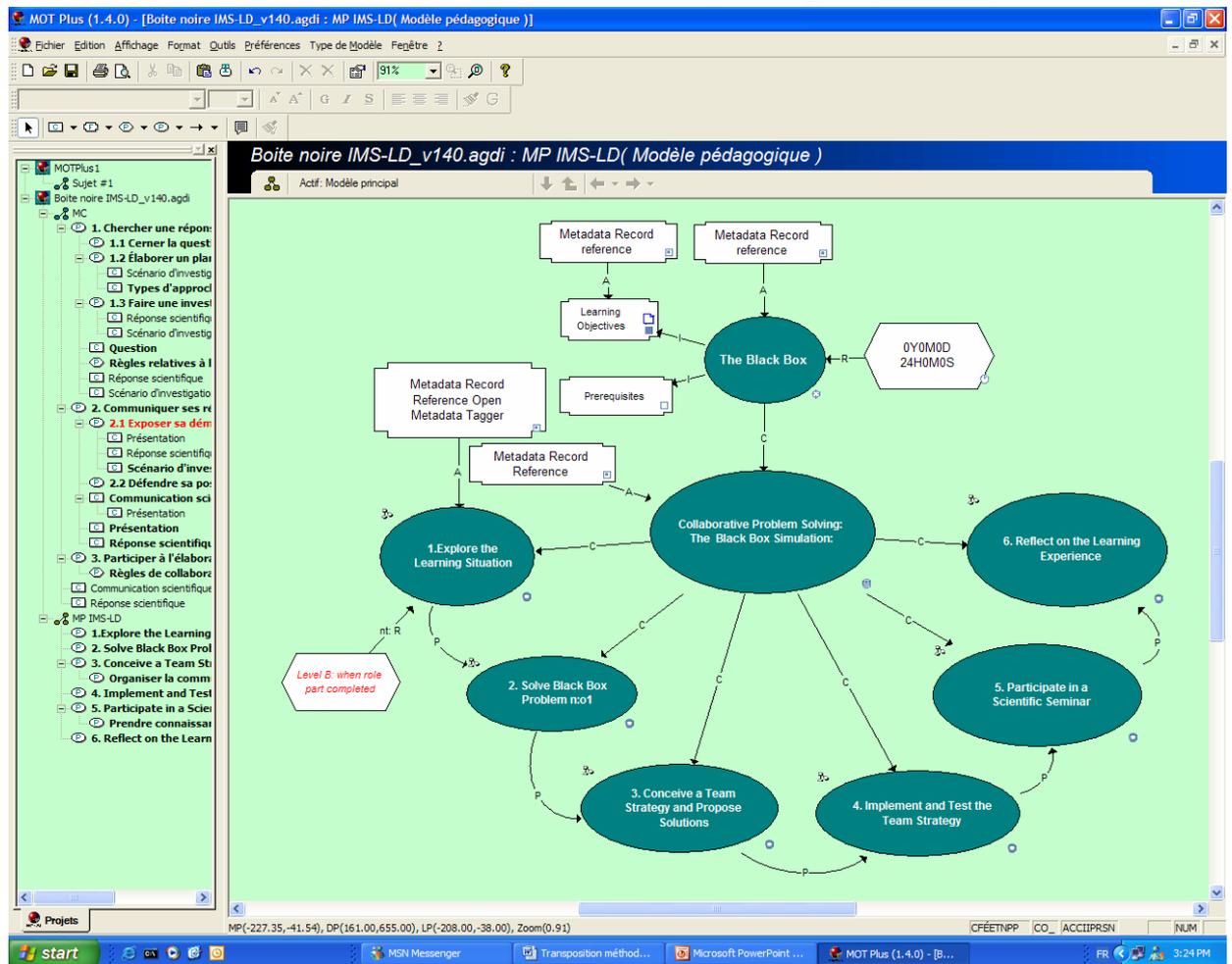


Figure 5: The MOT+ LD representation of the « Black Box » UoL



delivery model in the MISA method.

It is important to keep in mind that MISA is a method while IMSLD is a Specification of machine readable concepts and bindings. This essential distinction does not allow for easy comparisons. However, this study showed that MISA and IMSLD share a similar conceptual framework and that they have a comparable learning structure, which makes possible the transposition. Both MISA and IMSLD use a graphical learning flow, but their procedural representations differ. In general, MISA presents a series of activities and related resources associated to one or more actors, while the IMSLD present a method, with plays and acts, each containing a series of role parts encompassing a role, activity and environment per actor. The table below shows the main differences between MISA and IMSLD.

MISA Method	IMSLD Specification
Planning and Validation	Design, Production, Delivery
User-Oriented	Technology-Oriented
4 models : Content, Pedagogical Strategy, Media and Delivery	1 model encompassing pedagogical strategy and delivery modes
Activity-based learning flow	Actor-based learning flow
Instructional design quality control	Ensures technical interoperability and reusability

*Table 2: Main differences between MISA and IMSLD*

Regardless of the improvements carried out on the GRC and the MOT+LD editor, the transposition of an existing pedagogical model remains a complex task for the designer who is not familiar with the IMSLD concepts. Moreover, it is important to emphasize that, as shown in this study, a MISA pedagogical model does not carry enough information to create a Unit of Learning, but also needs to incorporate information from the MISA delivery model, the material model as well as certain types of information gathered during the preliminary analysis phase. This confirms that the construction of a UoL must be supported by an Instructional Design method to enable some quality control. The figure below (adapted from Lundgren Cayrol and Léonard, 2004) shows the main tasks (ovals)

from the MISA method as well as the products and elements of the method needed to support the design of an IMSLD UoL.

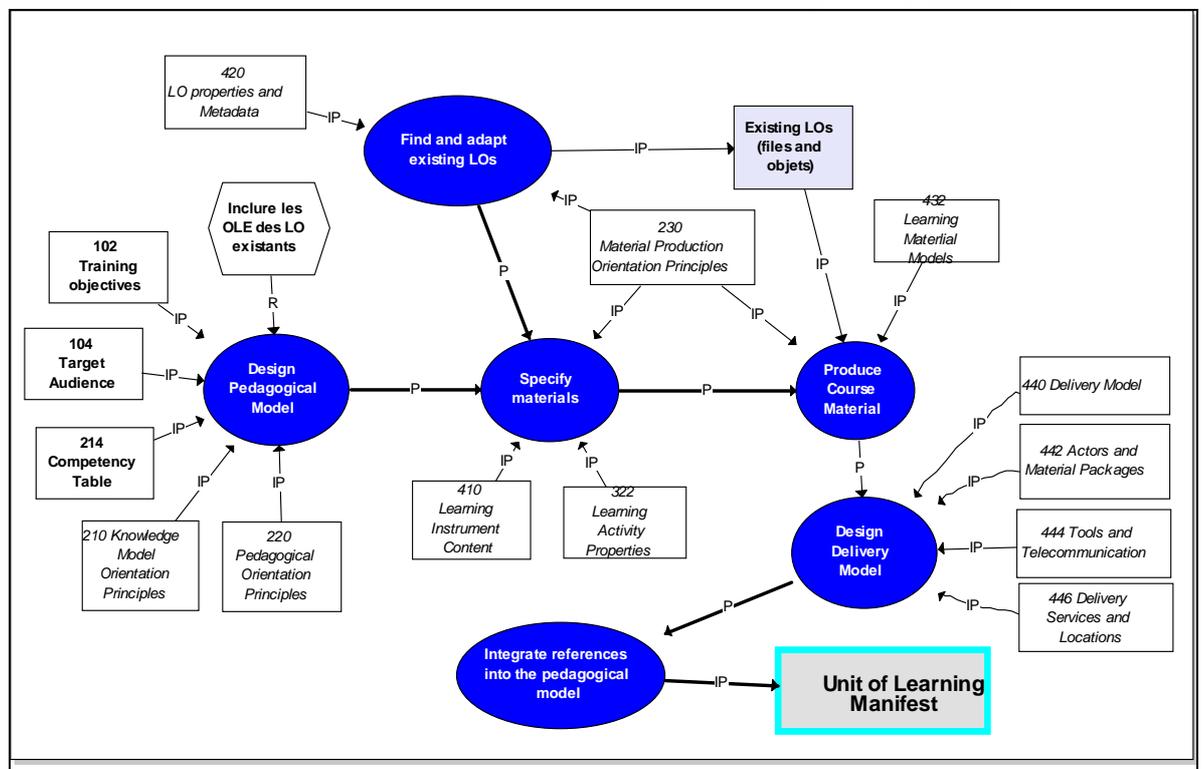


Figure 7: Course Designer's Task Model and MISA Documentation Elements

In general, the designer's task appears to be simplified by intentionally constructing a Unit of Learning, rather than elaborating three models, namely the pedagogical, material and delivery model, and then transposing these into one IMSLD conformant Unit of Learning Model. This has now become possible using the MOT+LD editor. However, in doing so the instructional quality may be compromised, since it does not imply any instructional design principles, which we believe are essential in order to promote interoperable and reusable Units of Learning.

## 5 Conclusions and Future R&D Activities

This study has shown that MISA is an ID method compatible with the IMSLD specification, because they share a lot of common conceptual elements permitting a harmonious binding. Equally, this study reveals that there is a need to expand the MOT+LD editor to the levels B and C and to obtain a level of expressiveness comparable to the MISA Learning System Engineering method.

Contrary to our initial impressions, this study revealed flexibility, expressiveness and capacity to expand concepts inherent in the IMSLD specification. These findings encourage the continuation work to further develop both a comprehensive method and a tool destined to facilitate the designer's tasks of producing IMSLD conformant UoL, without having to deal with the syntax and semantics of the XML. To do so, the graphical modelling technique is advantageous (Paquette et al., 2002) because it relies on conceptual understanding of the IMSLD elements and allows moreover a global view of the structure of the learning scenario.

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## 7 Footnotes

[1] EduSource project. [http://www.edusource.ca/english/home\\_eng.html](http://www.edusource.ca/english/home_eng.html)

[2] R2R: Learning Design Project. <http://commons.ucalgary.ca/weblogs/learningdesign/>

[3] LORNET Project. <http://www.lornet.org/>