




The 15th IEEE International Conference on Advanced Learning Technologies - ICALT2015  
July 6-9, 2015  
Hualien, Taiwan




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# Making explicit the Moodle instructional design language

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TEL (Technology-Enhanced Learning) Team




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## Presentation outline


- Context
- The GraphiT project
- Our approach / Moodle case study
- Conclusion & Perspectives




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## Context

- Learning Management Systems like MOODLE
  - Widespread within academic organizations
  - Not limited to distant courses
  - Provide many tools and services to teachers-designers

But

- Institutions impose a specific LMS to teachers
- Teachers are (sometimes) trained on how to use it
  - Not how to design learning situations on the LMSs
  - Not how to abstract instruction design from technical/administrative details


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# The GraphiT project



- **General informations**
  - Funded by the french national research agency (ANR)
  - Start/End: February 2012 / September 2015
  - Website : <http://www-lium.univ-lemans.fr/~laforcad/graphit/>
  - Involved several research members from our LIUM laboratory
- **Objectives**
  - Provide teachers with graphical learning design language
    - Compatible with LMS
  - Help to focus on the pedagogical aspect of the scenario
    - Instead of setting-up complex tools
  - Foster individual reflection about learning design
  - Improve uses of the existent LMSs



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# The GraphiT project

(a) Define a process to extract the ID languages

(b) Develop an external editor

(c) Upload scenarios

(d) Develop an API

(e) Integrate into

(f) Use the editor to define pedagogical scenarios

(g) LMS languages

Our approach

Instructional designer

Editor

API


Meta-model

LMSs and Platforms


Instructional designer

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## The identification and the formalization process

- We define the necessary analysis and steps for the identification and formalization of an LMS instructional design language.
- It is specified according to three different viewpoints:
  - a viewpoint centred on macro-HMI
  - a functional viewpoint
  - a micro viewpoint.
- Formalism : the meta-model format

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## The identification and the formalization process : An overview

```


graph LR
    Start(( )) --> A[Macro-HMI analysis]
    A --> B[macro-HMI model]
    B --> C[Functional analysis]
    B --> D[Factorization]
    C --> E[Functional model]
    D --> F[Macro model]
    E --> G[Micro analysis]
    F --> G
    G --> H[Final model]
    H --> End(( ))
  
```

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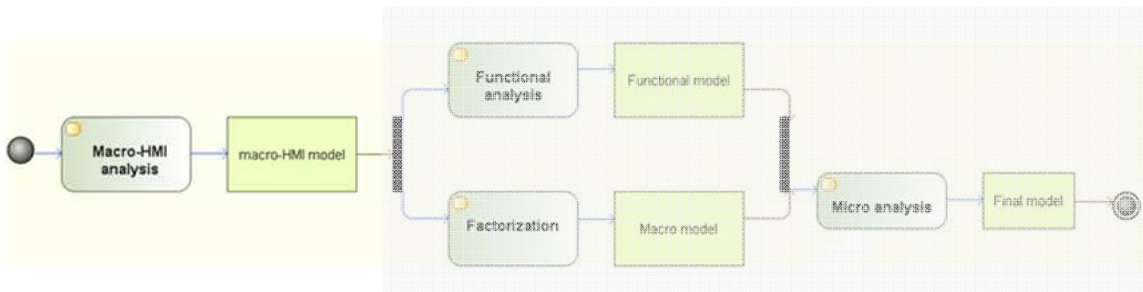


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# The macro IHM analysis



```


graph LR
    A(( )) --> B[Macro-HMI analysis]
    B --> C[macro-HMI model]
    C --> D[Functional analysis]
    C --> E[Factorization]
    D --> F[Functional model]
    E --> G[Macro model]
    F --> H[Micro analysis]
    G --> H
    H --> I[Final model]
    I --> J(( ))
  
```

**Objective** : identify platform interfaces related to the Instructional Design (ID).





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## Moodle 2.4 macro-HMI analysis

Course1
Connecté sous le nom « teacher1 teacher1 » (Déconnexion)

Accueil ► Mes cours ► C1
Quitter le mode édition

**Navigation**

**Réglages**

- Administration du cours
- Quitter le mode édition
- Paramètres
- Utilisateurs
- Filtres
- Notes
- Sauvegarde
- Restauration

**Aperçu des sections**

Ajouter une ressource... Ajouter une activité...

Ajouter une ressource... Ajouter une activité...

Dossier Atelier

**Ajouter Forum**

**Atelier (par groupe)**

Phase de mise en place	Phase de remise		Phase d'évaluation		Phase de notation de l'évaluation		Fermé
	Attribuer les travaux	remis : 0	Attribuer les travaux	calculés : 0	Calculer les notes des travaux	attendus : 0	
X Fournir un texte d'introduction pour l'atelier	0	0	0	0	0	0	
X Fournir des instructions pour la remise des travaux	0	0	0	0	0	0	
Préparer le formulaire d'évaluation	0	0	0	0	0	0	


**Leçon**

Preview Edit Reports Grade Essays


An Unseen question within a cluster jump or an Unseen question page jump is being used in this lesson. The nextPage used instead. Login as a student to test these jumps.

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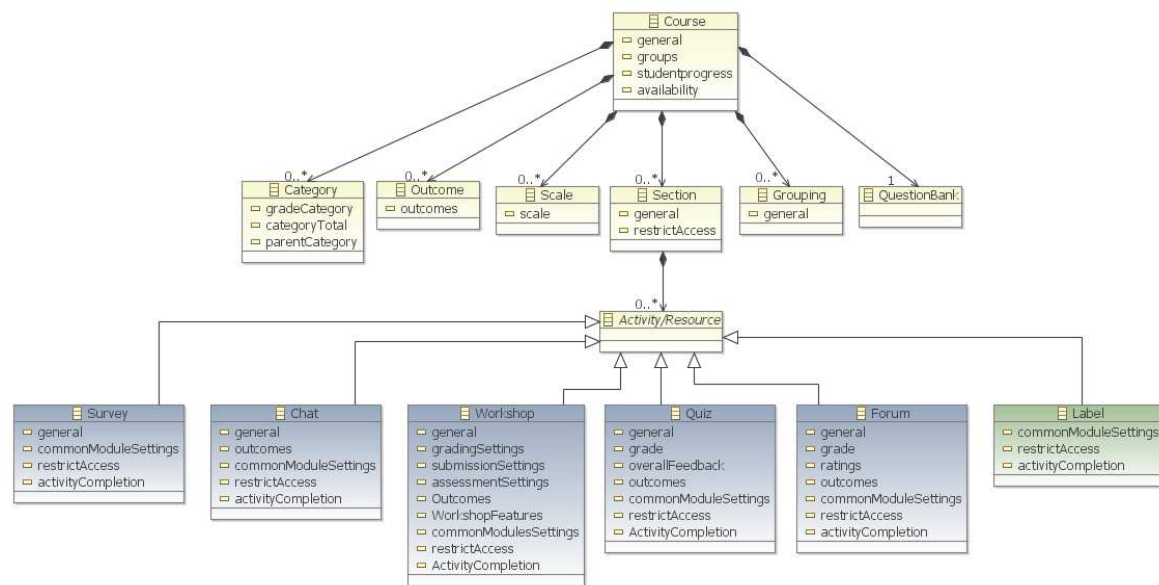


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## An extract of Moodle 2.4 macro-HMI model



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# The factorization analysis


```

graph LR
    A[Macro-HMI analysis] --> B[macro-HMI model]
    B --> C[Functional analysis]
    B --> D[Factorization]
    C --> E[Functional model]
    D --> F[Macro model]
    E --> G[Micro analysis]
    F --> G
    G --> H[Final model]
  
```


**Objective** : find common elements in pedagogical activities/resources and common relations between them.

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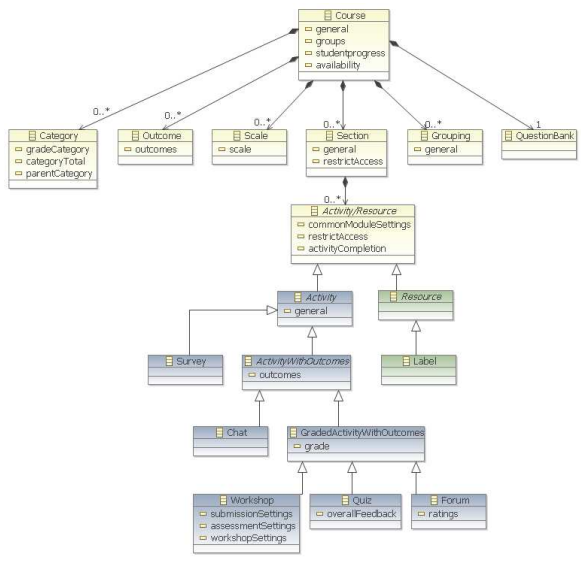


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## An extract of Moodle 2.4 Moodle Macro model



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# The functional analysis

```

graph LR
    A[Macro-HMI analysis] --> B[macro-HMI model]
    B --> C[Functional analysis]
    B --> D[Factorization]
    C --> E[Functional model]
    D --> F[Macro model]
    E --> G[Micro analysis]
    F --> G
    G --> H[Final model]
  
```

**Objective :** identify the functionalities dedicated to the course instructional design.

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## Moodle 2.4 functional analysis

**Course1**
1
Connecté sous le nom « teacher1 teacher1 » (Déconnexion)

Accueil ► Mes cours ► C1
Quitter le mode édition

**Navigation**

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Règlages

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- Quitter le mode édition
- Paramètres
- Utilisateurs**
- Filtres
- Notes
- Sauvegarde
- Restauration
- Importation
- Réinitialisation
- Banque de questions
- Prendre le rôle...
- Réglages de mon profil


**Aperçu des sections**

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	Ajouter une ressource...	Ajouter une activité...
1	Dossier Étiquette Fichier Page Paquetage IMS Content URL	Atelier Base de données Chat Consultation <b>Devoirs</b> Dépôt avancé de fichiers Texte en ligne Déposer un fichier Activité hors ligne
2	Ajouter une ressource...	Forum Glossaire Leçon Paquetage SCORM Sondage Test Wiki
3	Ajouter une ressource...	
4	Ajouter une ressource...	

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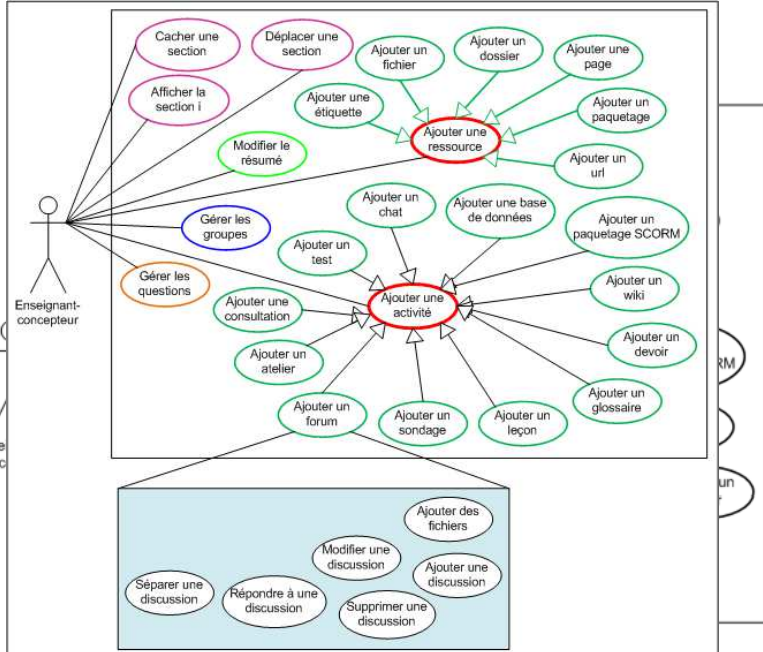


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## An extract of Moodle 2.4 functional model



The diagram illustrates the functional model of Moodle 2.4. It features a central actor, 'Enseignant-concepteur', who interacts with two main functional areas: 'Ajouter une ressource' (Add resource) and 'Ajouter une activité' (Add activity). 'Ajouter une ressource' includes sub-functions such as 'Ajouter un fichier', 'Ajouter un dossier', 'Ajouter une page', 'Ajouter un paquetage', 'Ajouter un url', 'Ajouter une étiquette', 'Ajouter un chat', 'Ajouter une base de données', 'Ajouter un SCORM', 'Ajouter un wiki', 'Ajouter un devoir', 'Ajouter un glossaire', 'Ajouter un sondage', 'Ajouter un leçon', 'Ajouter un forum', 'Ajouter un atelier', 'Ajouter une consultation', 'Ajouter un test', 'Ajouter un résumé', 'Ajouter une question', 'Ajouter une consultation', 'Ajouter un atelier', 'Ajouter un forum', 'Ajouter un sondage', 'Ajouter un leçon', 'Ajouter un glossaire', 'Ajouter un devoir', 'Ajouter un wiki', 'Ajouter un devoir', 'Ajouter un glossaire'. 'Ajouter une activité' includes sub-functions such as 'Ajouter un chat', 'Ajouter une base de données', 'Ajouter un SCORM', 'Ajouter un wiki', 'Ajouter un devoir', 'Ajouter un glossaire', 'Ajouter un sondage', 'Ajouter un leçon', 'Ajouter un forum', 'Ajouter un atelier', 'Ajouter une consultation', 'Ajouter un test', 'Ajouter un résumé', 'Ajouter une question', 'Ajouter une consultation', 'Ajouter un atelier', 'Ajouter un forum', 'Ajouter un sondage', 'Ajouter un leçon', 'Ajouter un glossaire', 'Ajouter un devoir', 'Ajouter un wiki', 'Ajouter un devoir', 'Ajouter un glossaire'. Other functions include 'Cacher une section', 'Déplacer une section', 'Afficher la section i', 'Gérer les groupes', 'Gérer les questions', 'Ajouter une ressource', 'Ajouter une activité', 'Ajouter des fichiers', 'Modifier une discussion', 'Ajouter une discussion', 'Séparer une discussion', 'Répondre à une discussion', 'Supprimer une discussion'.

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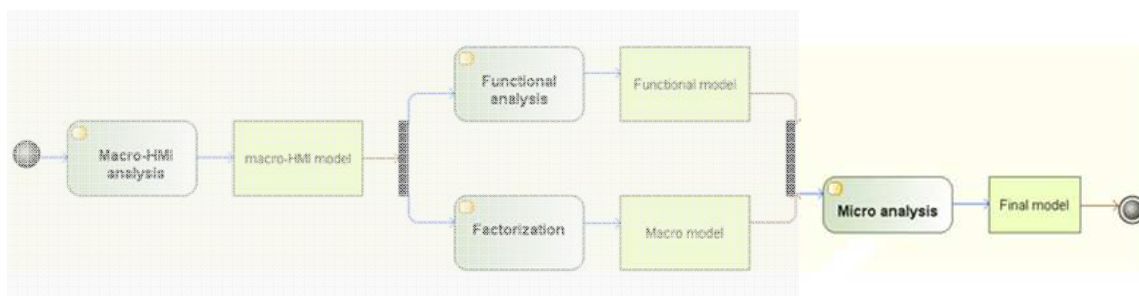


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# The micro analysis



**Objective** : takes into account two different viewpoints: micro-HMI and technical viewpoints.

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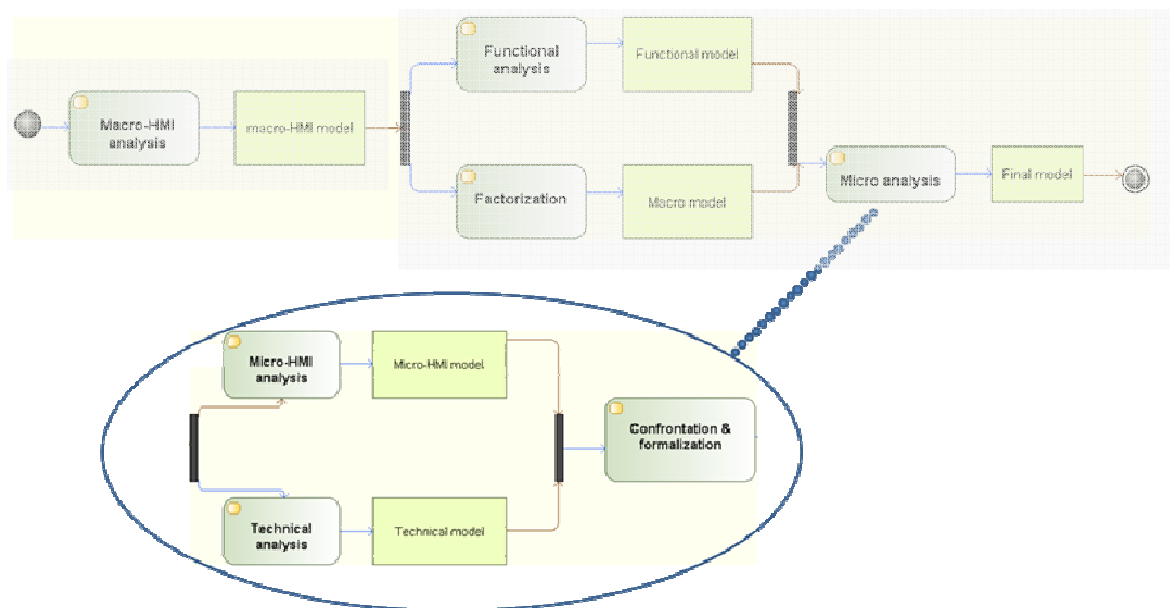


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# The micro analysis



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## The micro HMI analysis (micro analysis)


```

graph LR
    FM[Functional model] --> MHA[Micro-HMI analysis]
    MM[Macro model] --> MHA
    MM --> TA[Technical analysis]
    MHA --> MHM[Micro-HMI model]
    TA --> TM[Technical model]
    MHM --> CFF[Confrontation & formalization]
    TM --> CFF
    CFF --> FM2[Final model]
  
```


**Objective :** identify all elements relevant to the instructional design, including their features (attributes, types, etc.).

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## Moodle 2.4 micro HMI analysis

**course1** Connecté sous le nom « teacher1 teacher1 » (Déconnexion)

Accueil ► Mes cours ► course1

**Navigation**

Accueil

- Ma page
- Pages du site
- Mon profil
- Mes cours
  - PW-PHP
  - course1

**Réglages**

- Administration du cours
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  - Paramètres
  - Utilisateurs
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  - Notes
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  - Réinitialisation
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- Prendre le rôle...
- Réglages de mon profil

### Ajouter Forum

**Généraux**

Nom du forum\*

Type de forum ?  
Forum standard pour utilisation générale

Introduction au forum\* ?

Police Taille police Format

**B** *I* U ~~ABC~~ x, x'

Chemin:


Format HTML

Mode d'abonnement  
Abonnement facultatif


Suivi des messages lus  
Facultatif

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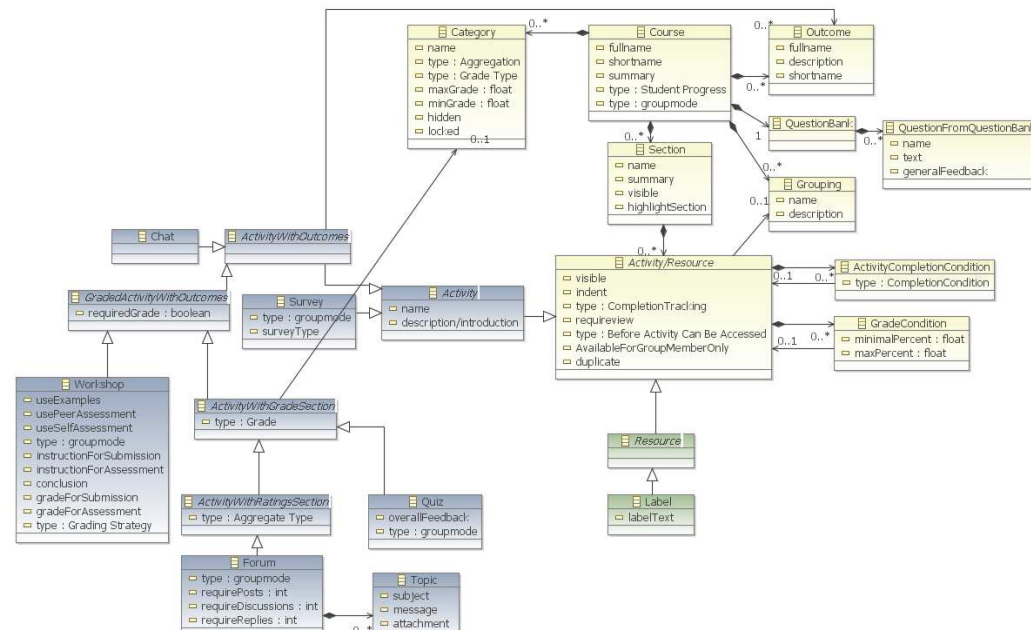


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## An extract of Moodle 2.4 micro HMI model



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## The technical analysis (micro analysis)

```

graph LR
    FM[Functional model] --> MHA[Micro-HMI analysis]
    MM[Macro model] --> MHA
    MHA --> MHM[Micro-HMI model]
    MM --> TA[Technical analysis]
    TA --> TM[Technical model]
    MHM --> CF[Confrontation & formalization]
    TM --> CF
    CF --> FM2[Final model]
  
```

**Objective :** specify a reduced Conceptual Data Model from the one available by LMS providers.

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## Moodle 2.4 technical analysis

- This technical analysis consists in
  - (1) looking over all database tables in order to sketch a first draft of the model,
  - (2) focusing on tables embedding elements in relation to instructional design concepts.

mdl23_assignment	filter_active	grade_import_values	mdl23_profiling
mdl23_assignment_submissions	filter_config	grade_items	mdl23_question
mdl23_backup_controllers	folder	grade_items_history	mdl23_question_answers
mdl23_backup_courses	forum	grade_letters	mdl23_question_attempts
mdl23_backup_files	forum_discussions	grade_outcomes	mdl23_question_calculated_options
mdl23_backup_files_template	forum_posts	grade_outcomes_courses	mdl23_question_calculated_options
mdl23_backup_ids	forum_queue	grade_outcomes_history	mdl23_question_categories
mdl23_backup_ids_template	forum_read	grade_settings	mdl23_question_datasets
mdl23_backup_log	forum_subscriptions	groupings	mdl23_question_dataset_definitions
mdl23_backup_logs	forum_track_prefs	groupings_groups	mdl23_question_dataset_items
mdl23_block	glossary	groups	mdl23_question_match
mdl23_block_community	glossary_alias	groups_members	mdl23_question_match_sub
mdl23_block_instances	glossary_categories	imscp	mdl23_question_multianswer
mdl23_block_instance_old	glossary_entries	label	mdl23_question_multichoice
mdl23_block_pinned_old	glossary_entries_categories	lesson	mdl23_question_numerical
mdl23_block_positions	glossary_formats	lesson_answers	mdl23_question_numerical_options
mdl23_block_rss_client	grade_categories	lesson_attempts	mdl23_question_numerical_units
mdl23_block_search_documents	grade_categories_history	lesson_branch	mdl23_question_randomsmatch
mdl23_blog_association	grade_grades	lesson_grades	mdl23_question_sessions
mdl23_blog_external	grade_grades_history	lesson_high_scores	mdl23_question_shortanswer
mdl23_cache_filters	grade_import_newitem	lesson_pages	mdl23_question_states
mdl23_cache_flags	grade_import_values	lesson_timer	mdl23_question_truefalse

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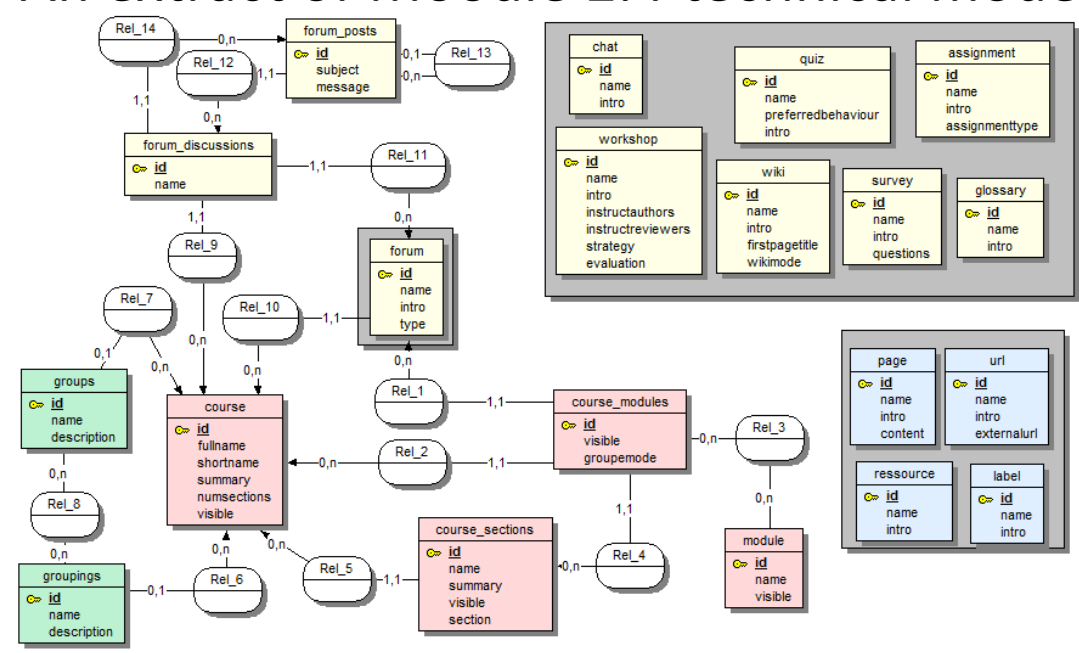
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## An extract of Moodle 2.4 technical model




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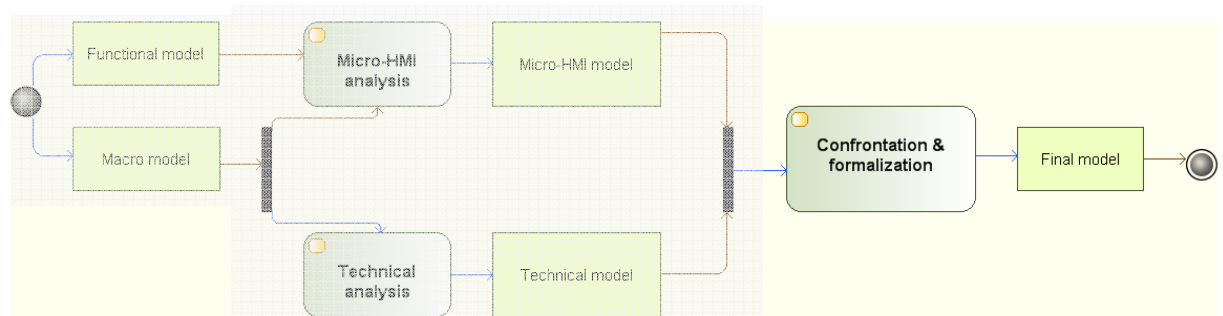


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## The Confrontation & formalization (micro analysis)



**Objective :** allows the confrontation of both micro-HMI and technical models, and the formalization of the final model.

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## The Confrontation and formalization (micro analysis)

- The micro-HMI and technical models are compared in order to
  - (1) refine the micro-HMI model
  - (2) detect and correct the difference between models
  - (3) ensure that the final model can be easily bind to a computer-readable format for the existent LMS.
  
- Some differences or ambiguities are so identified. They require a deeper and finer analysis of both HMI and technical analysis. At this step, other technical-centred analysis (source code, backup packages, etc.) are used.

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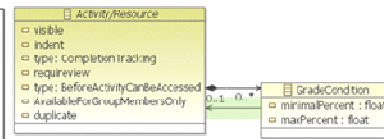
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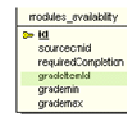


# The Confrontation and formalization

```
// Check grade
if (!is_null($cm->completiongradestemnumber)) {
    require_once($CFG->libdir.'/gradelib.php');
    $items = grade_items::fetch(array('courseid' => $cm->course, 'instancetype' => 'mod',
    'itemmodule' => $cm->modname, 'iteminstance' => $cm->instance,
    'itemnumber' => $cm->completiongradestemnumber));
    if ($items) {
        // Patch 'grades' (will be done at some)
        $grades = grade_grade::fetch_user_grades($items, array($userid), false);
        if (empty($grades)) {
            // No grade for user
            return COMPLETION_INCOMPLETE;
        }
        if (count($grades) > 1) {
            $this->internal_systemerror("Unexpected result: multiple grades for
            item '{$item->id}', user '{$userid}'");
        }
        $newstate = self::internal_get_grade_state($items, reset($grades));
        if ($newstate == COMPLETION_INCOMPLETE) {
            return COMPLETION_INCOMPLETE;
        }
    } else {
        $this->internal_systemerror("Cannot find grade item for '{$cm->modname}'
        '{$cm->id}' matching number '{$cm->completiongradestemnumber}'");
    }
}
```

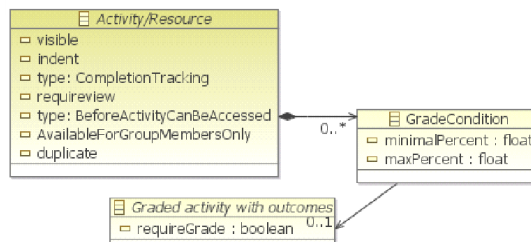


Association relationship between « Activity/Resource » and « GradeCondition » according to the micro HMI analysis



« GradeCondition » according to the technical analysis

Part of the source code moodle/lib/conditionlib.php



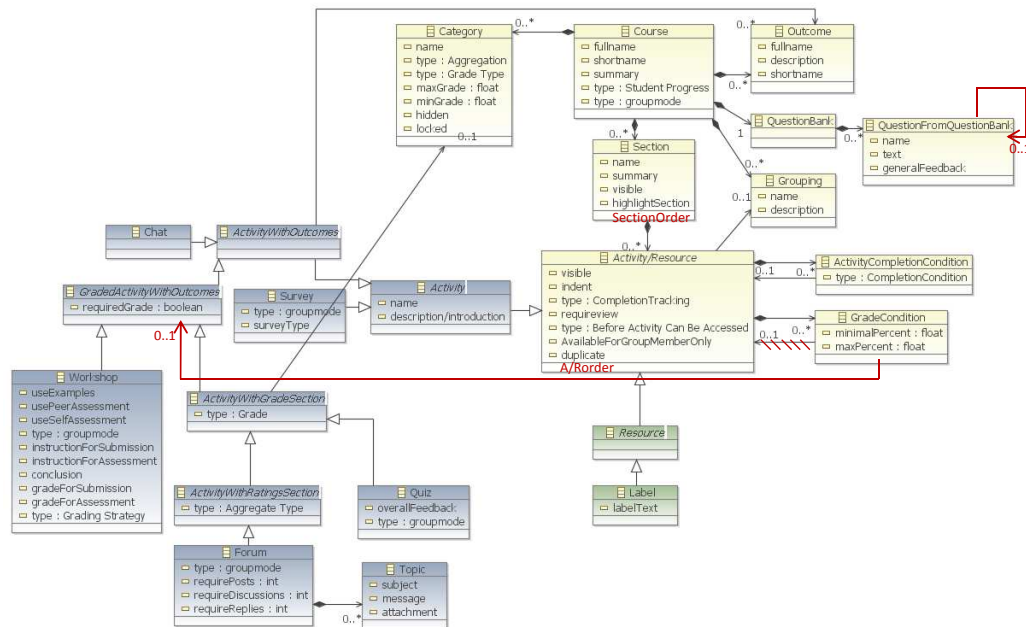


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# An extract of Moodle 2.4 final model

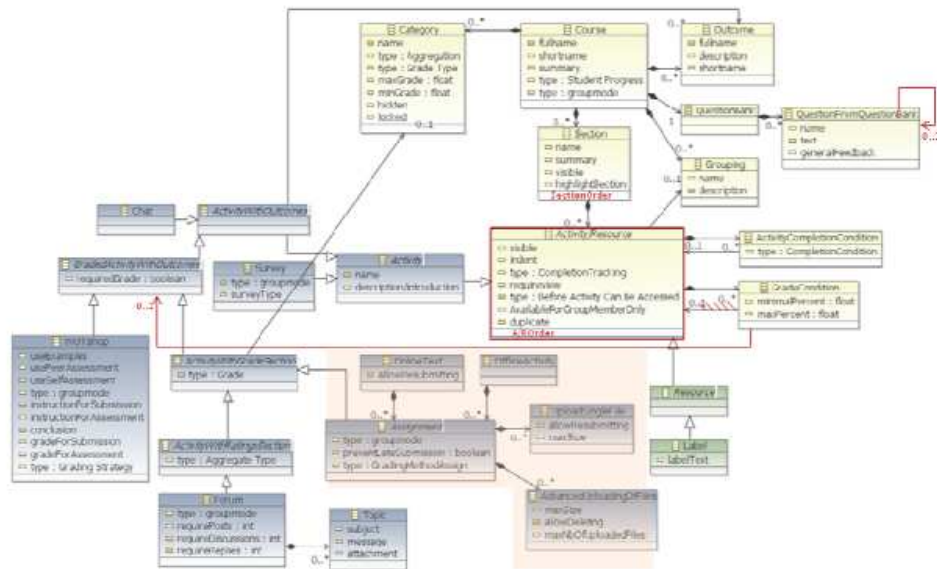





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# An extract of Moodle 2.0 final model





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## Difference between Moodle 2.4 and Moodle 2.0 meta-models





	Moodle 2.4	Moodle 2.0	Comments
<b>External Tool class</b>	Yes	No	The external tool activity module enables students to interact with learning resources and activities on other web sites.
<b>Book class</b>	Yes	No	The book module enables a teacher to create a multi-page resource in a book-like format, with chapters and subchapters.
<b>Relation between Section &amp; ActivityCompletionCondition classes</b>	Yes	No	This relation determines any activity completion conditions which must be met in order to access the section.
<b>Relation between Section and GradeCondition classes</b>	Yes	No	This relation determines any grade conditions which must be met in order to access the activity.
<b>Assignment class</b>	Yes	Yes	In Moodle 2.4 we have 1 class for assignment (Assignment) while in Moodle 2.0 we have 4 classes for assignment (Online text, Advanced uploading files, Offline activity and Upload single file).
<b>blindMarking attribute for Assignment class</b>	Yes	No	Blind marking hides the identity of students to markers.
<b>gradingMethodAssignment attribute for Assignment class</b>	Yes	No	This attribute defines the advanced grading method (Simple direct grading, Marking guide, Rubric) used for calculating grades in the assignment.
<b>Relation between Assignment and Grouping classes</b>	Yes	No	Students are able to collaborate on an assignment.

Context
The GraphiT project
Our approach/Moodle case study
Conclusion & Perspectives

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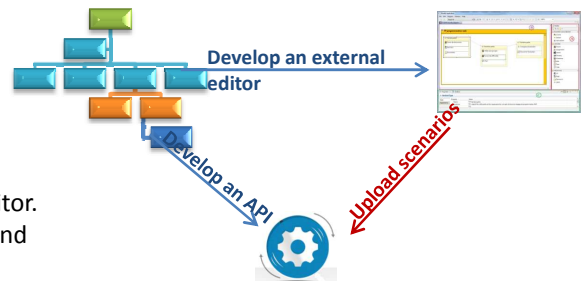


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## Conclusion & Perspectives

- Propose a meta-model-based approach and method for identifying and formalizing LMS languages.
- We apply our proposed method on the Moodle 2.4 platform
- We have also applied our method on the Moodle 2.0 and Dokeos platforms
- The meta-model will be used as :
  - a basis for the development of the external editor.
  - A communication format between the editor and the LMS
- This will facilitate the use of LMS and allow to teachers and pedagogical engineers of becoming more familiar with the specific design upon this LMS.




Context	The GraphiT project	Our approach/Moodle case study	<b>Conclusion &amp; Perspectives</b>
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# Making explicit the Moodle instructional design language

# Thank you!

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