

A method for identifying and formalizing the underlying instructional design language of existent LMSs

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Presentation outline

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

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

The GraphiT project



- **General informations**

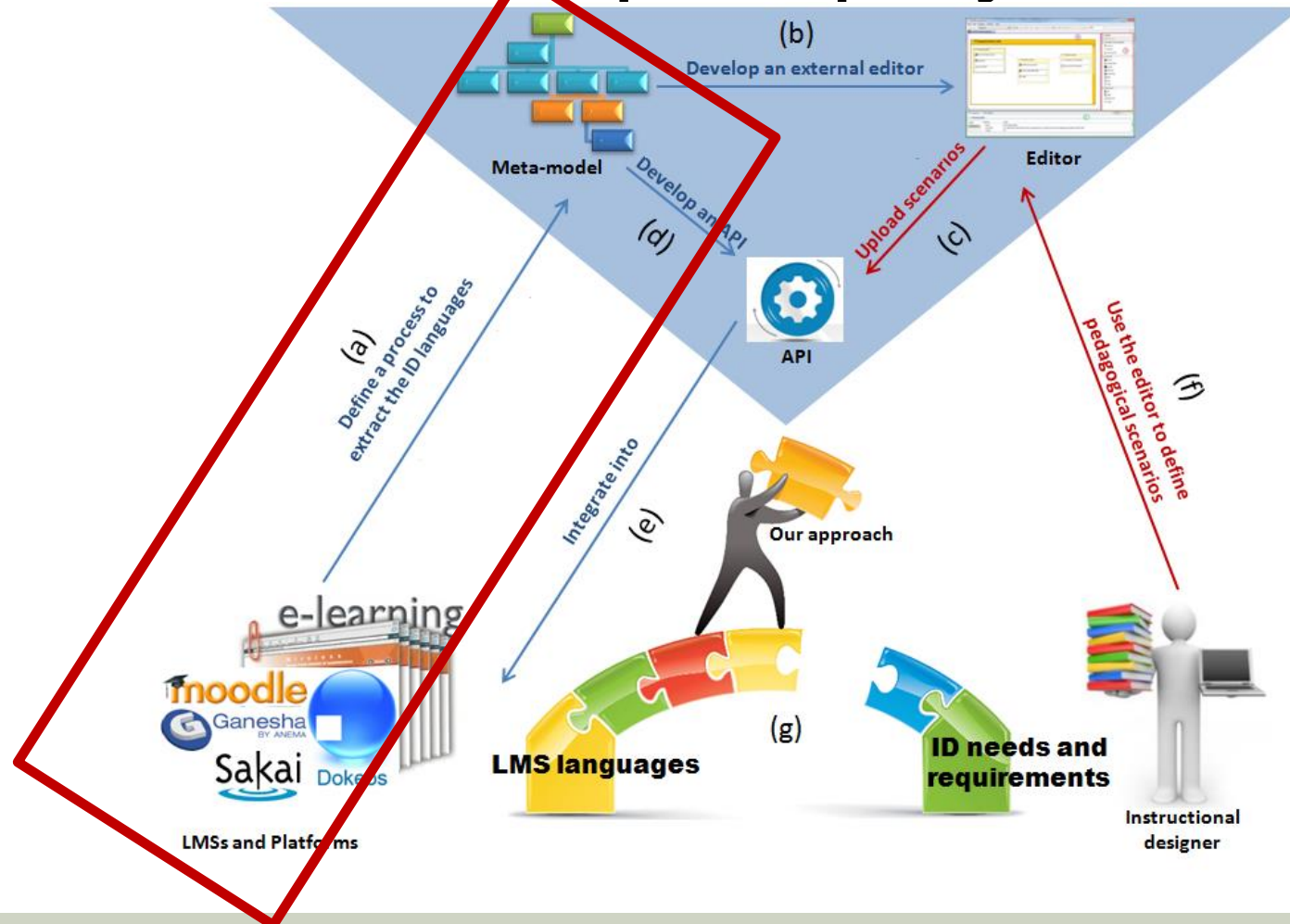
- Funded by the french national research agency (ANR)
- Start/End: February 2012 / September 2015
- Website : <http://www-lium.univ-lemans.fr/~laforcad/graphit/>
- Involved several research members from our LIUM laboratory



- **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

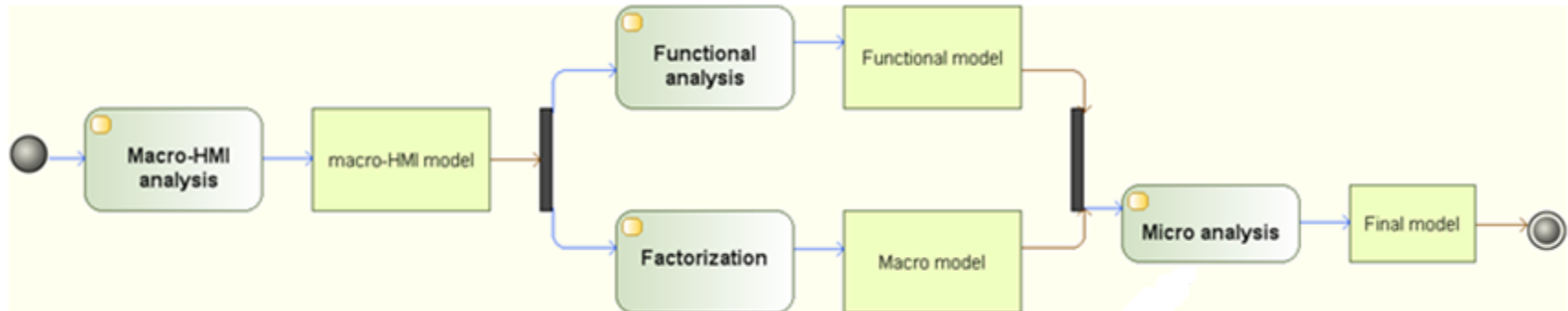
The GraphiT project



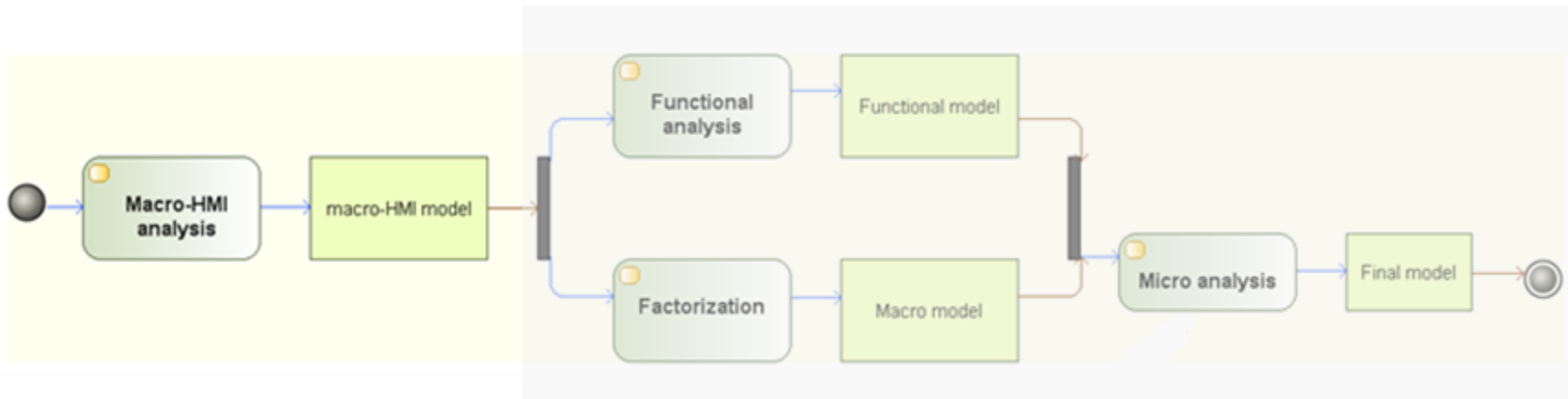
The identification and the formalization process

- 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

The identification and the formalization process : An overview



The macro IHM analysis



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

Moodle macro-HMI analysis

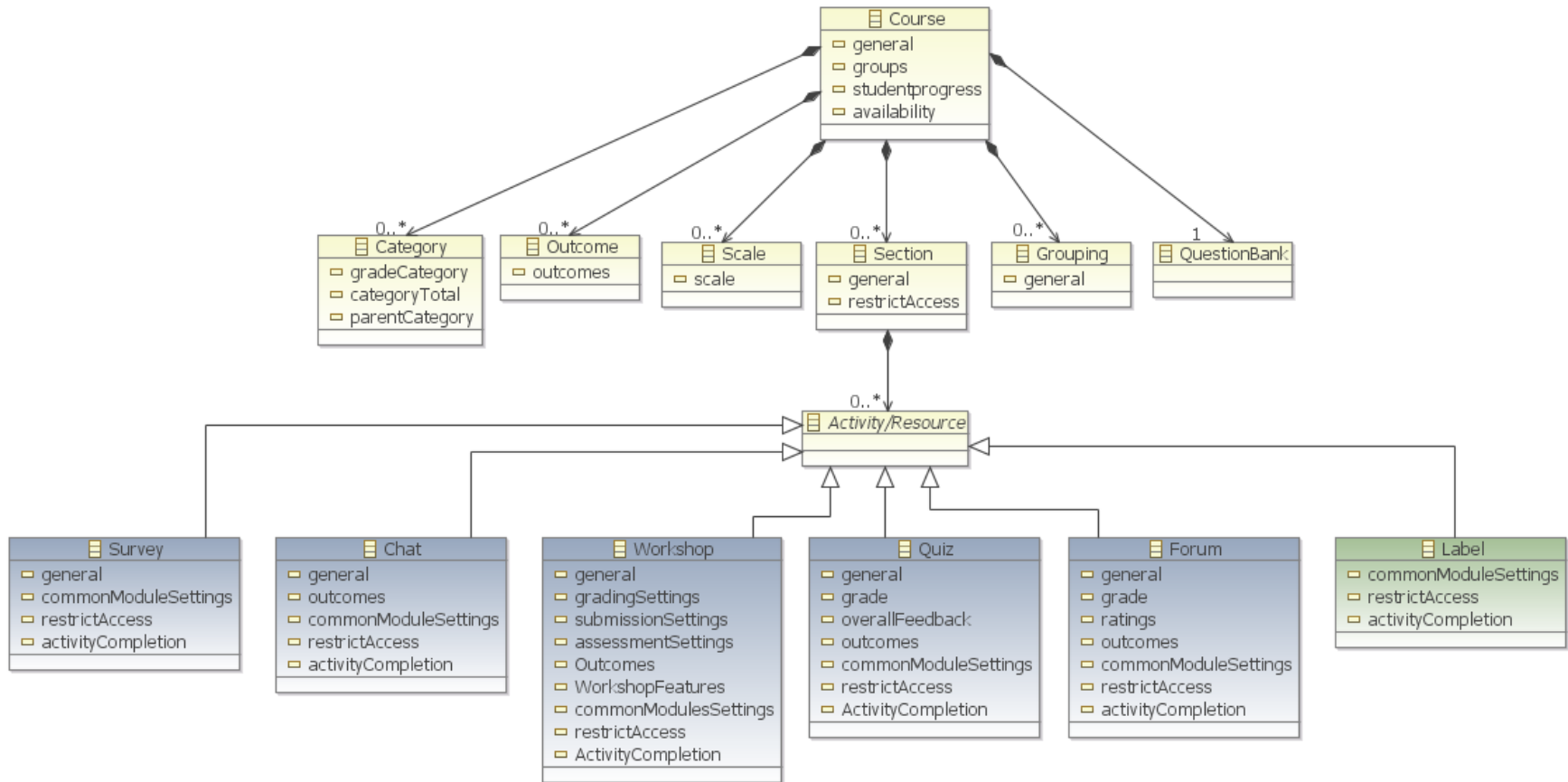
The screenshot shows the Moodle course editor interface. Key elements are highlighted with red circles and callouts:

- Course1**: The course name at the top left.
- Ajouter Forum**: A callout pointing to the 'Ajouter une activité...' dropdown menu.
- Atelier (par groupe)**: A callout pointing to the 'Atelier (par groupe)' option in the activity selection table.
- Leçon**: A callout pointing to the 'Leçon' option in the activity selection table.

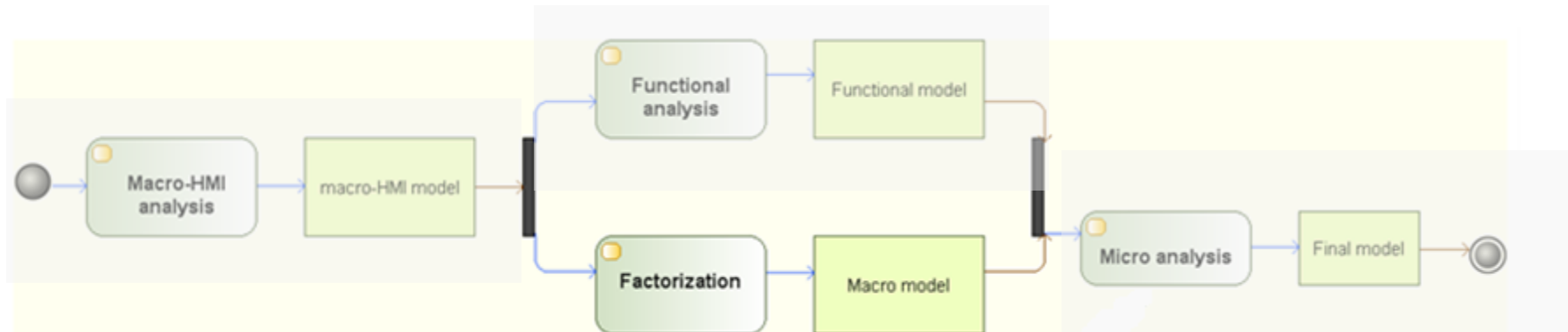
The activity selection table is as follows:

Phase de mise en place	Phase de remise	Phase d'évaluation	Phase de notation de l'évaluation	Fermé
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Fournir un texte d'introduction pour l'atelier <input checked="" type="checkbox"/> Fournir des instructions pour la remise des travaux <input type="checkbox"/> Préparer le formulaire d'évaluation 	<input type="checkbox"/> Attribuer les travaux attendus : 0 remis : 0 à attribuer : 0	<input checked="" type="checkbox"/> Calculer les notes des travaux remis attendus : 0 calculées : 0	<input checked="" type="checkbox"/> Calculer les notes des évaluations attendus : 0 calculées : 0	<input type="checkbox"/>

An extract of Moodle macro-HMI model

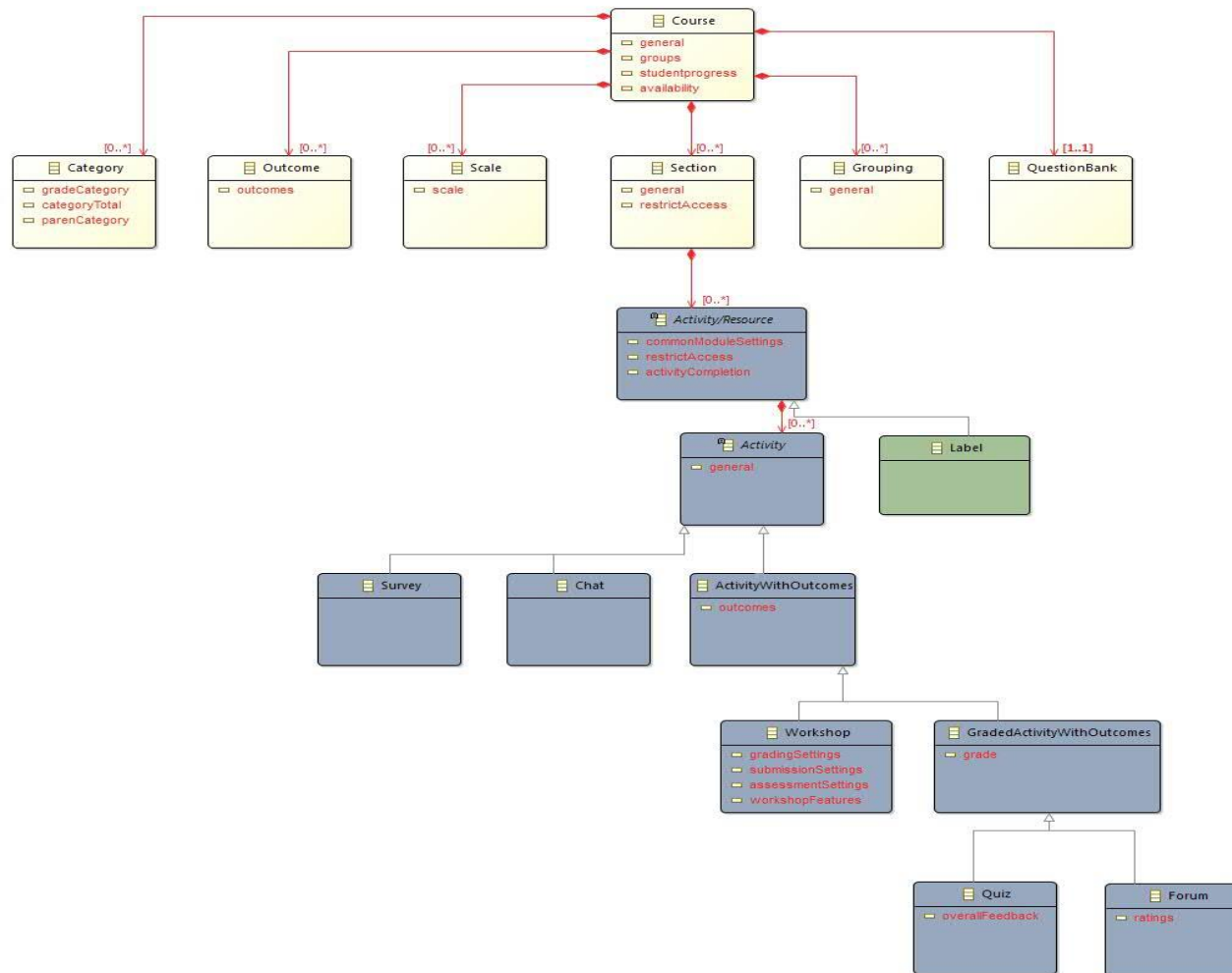


The factorization analysis

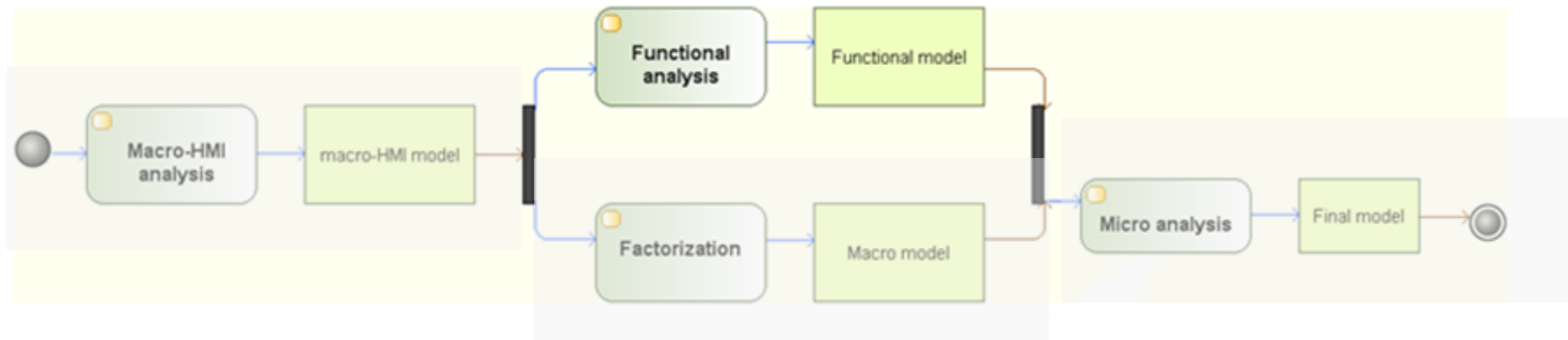


Objective : find common elements in pedagogical activities/resources and common relations between them.

An extract of Moodle Moodle Macro



The functional analysis



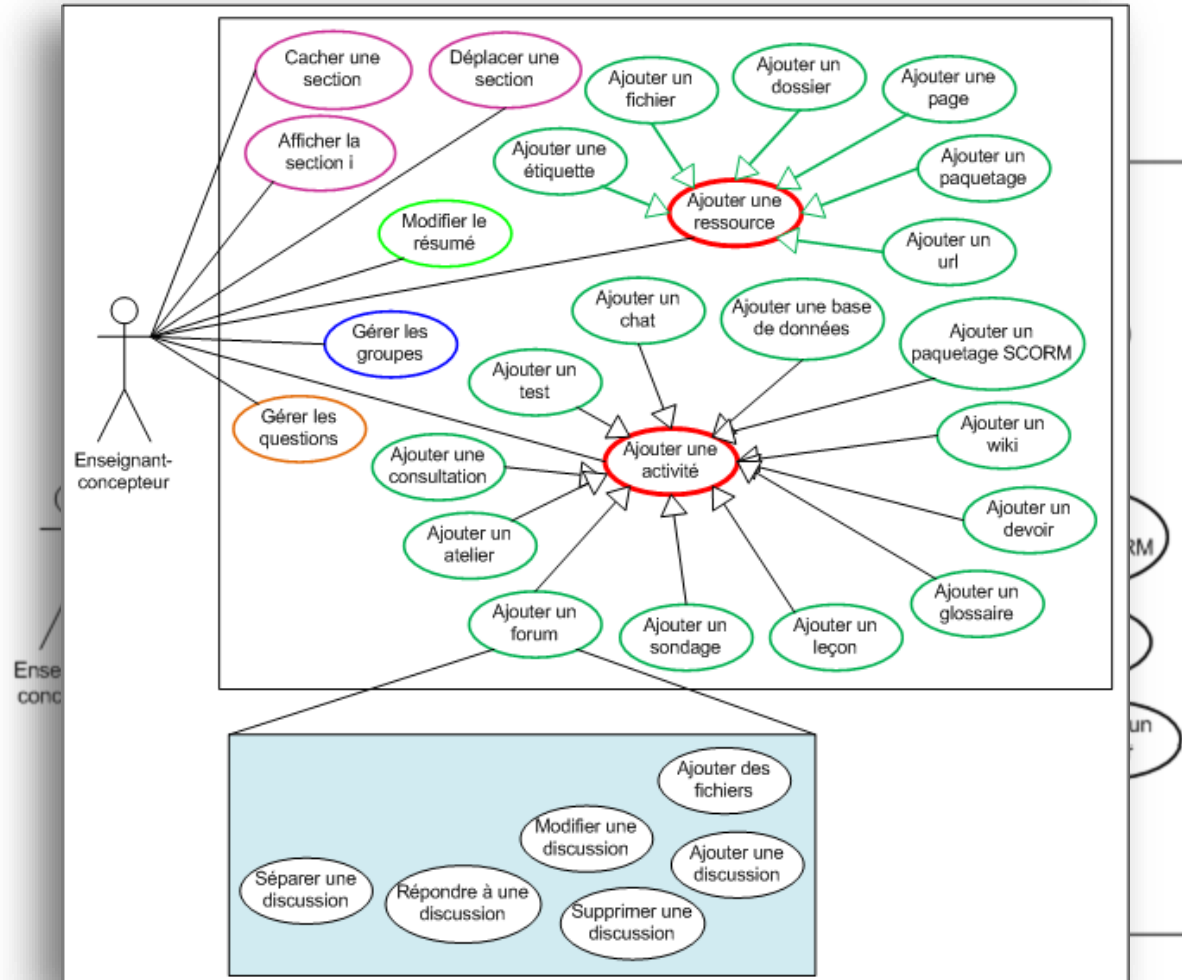
Objective : identify the functionalities dedicated to the course instructional design.

Moodle functional analysis

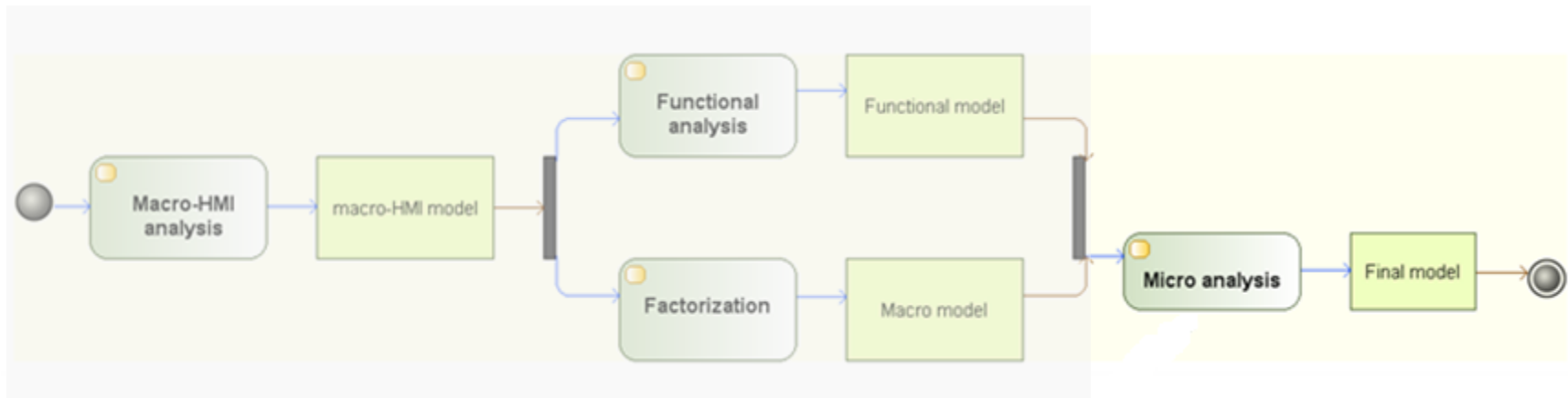
The screenshot shows the Moodle Course1 interface with several key elements highlighted for functional analysis:

- 1**: The user is logged in as « teacher1 teacher1 » (Déconnexion) in Français (fr).
- 2**: The left sidebar (Navigation and Réglages) is highlighted. The 'Utilisateurs' option is selected, and the 'Banque de questions' option is highlighted with an orange box.
- 3**: The 'Aperçu des sections' (Section Overview) area is highlighted. It shows a list of sections (1, 2, 3, 4) with 'Ajouter une ressource...' and 'Ajouter une activité...' dropdown menus. The 'Ajouter une ressource...' menu is highlighted with a green box, and the 'Ajouter une activité...' menu is highlighted with a red box. The 'Devoirs' (Assignments) category is expanded, showing options like 'Dépôt avancé de fichiers', 'Texte en ligne', 'Déposer un fichier', and 'Activité hors ligne'.

An extract of Moodle functional model

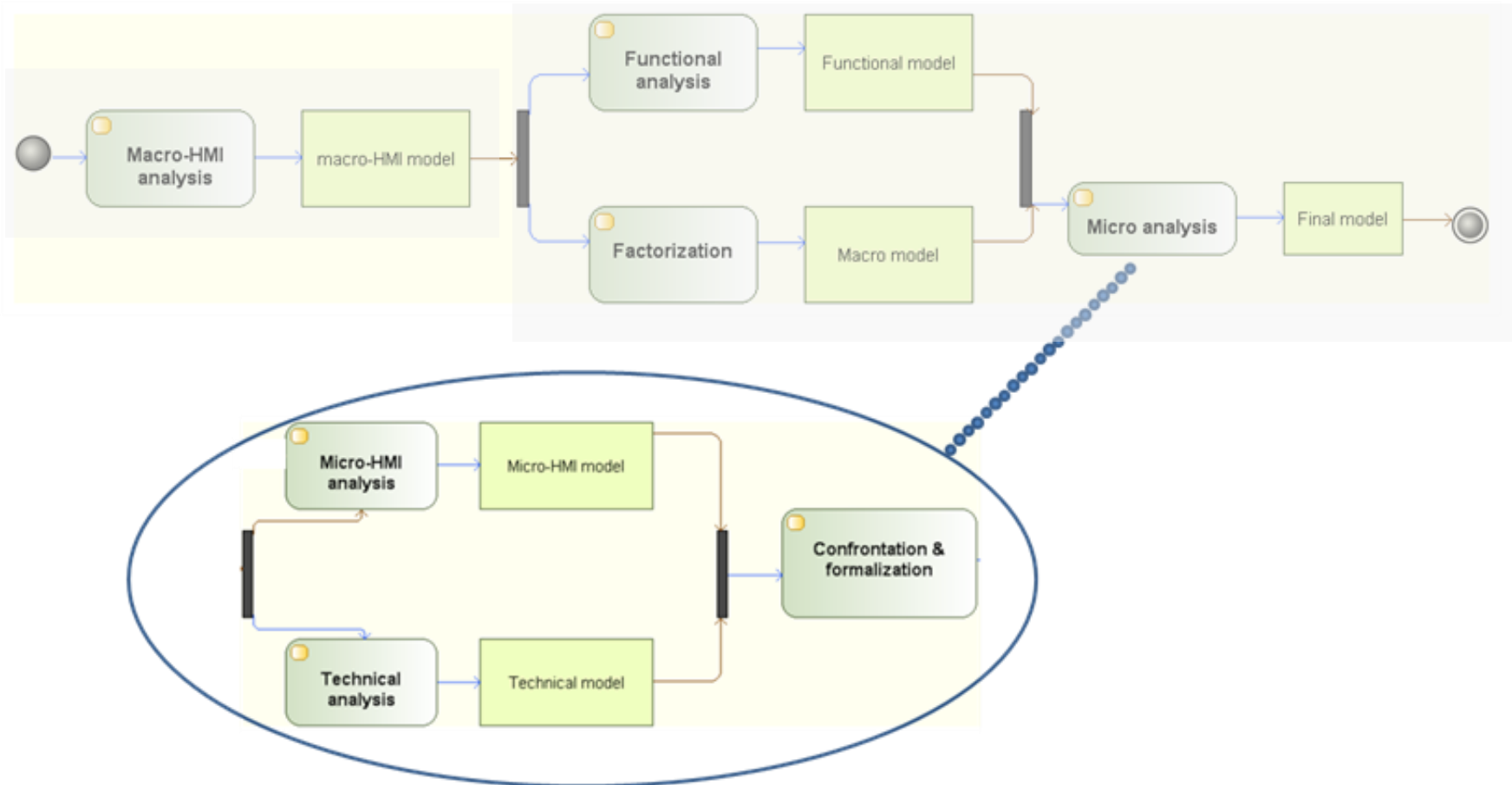


The micro analysis

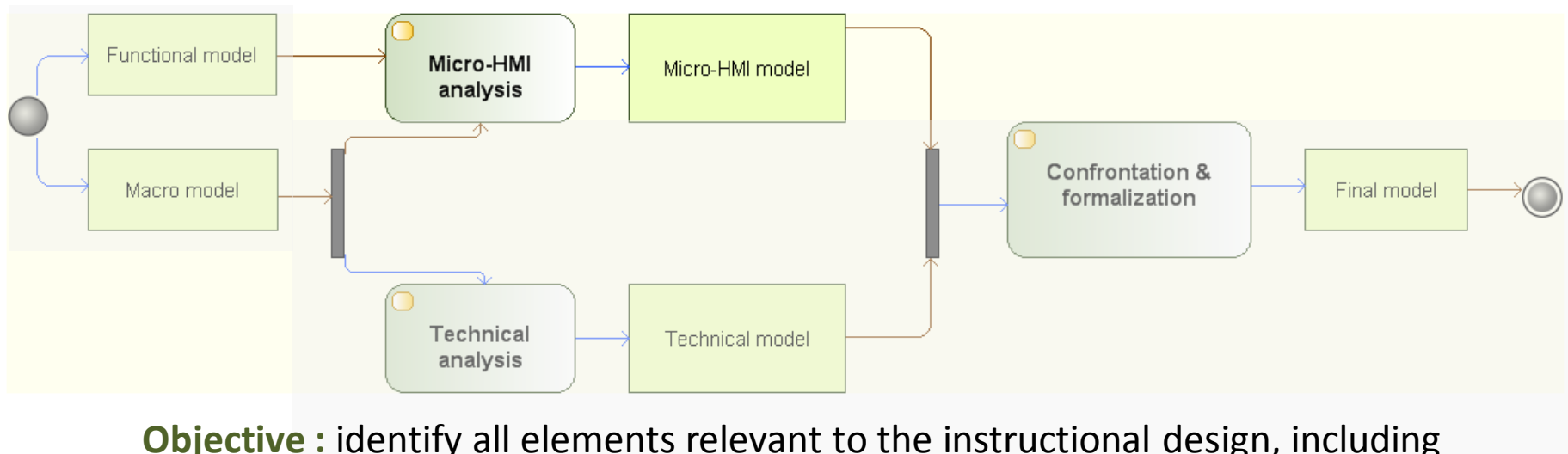


Objective : takes into account two different viewpoints: micro-HMI and technical viewpoints.

The micro analysis



The micro HMI analysis (micro analysis)



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

Moodle micro HMI analysis

The screenshot shows the Moodle 'Ajouter Forum' (Add Forum) page. The page is titled 'course1' and includes a navigation breadcrumb 'Accueil > Mes cours > course1'. The main content area is titled 'Ajouter Forum' and contains a 'Généraux' section with various form fields and a rich text editor. Three red circles with numbers 1, 2, and 3 are overlaid on the page to highlight specific elements: 1 is on the top navigation bar, 2 is on the left sidebar menu, and 3 is on the main content area title.

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

Ajouter Forum

Généraux

Nom du forum*

Type de forum

Introduction au forum*

Police Taille police Format

B *I* U ABC x₂ x² [List Icons]

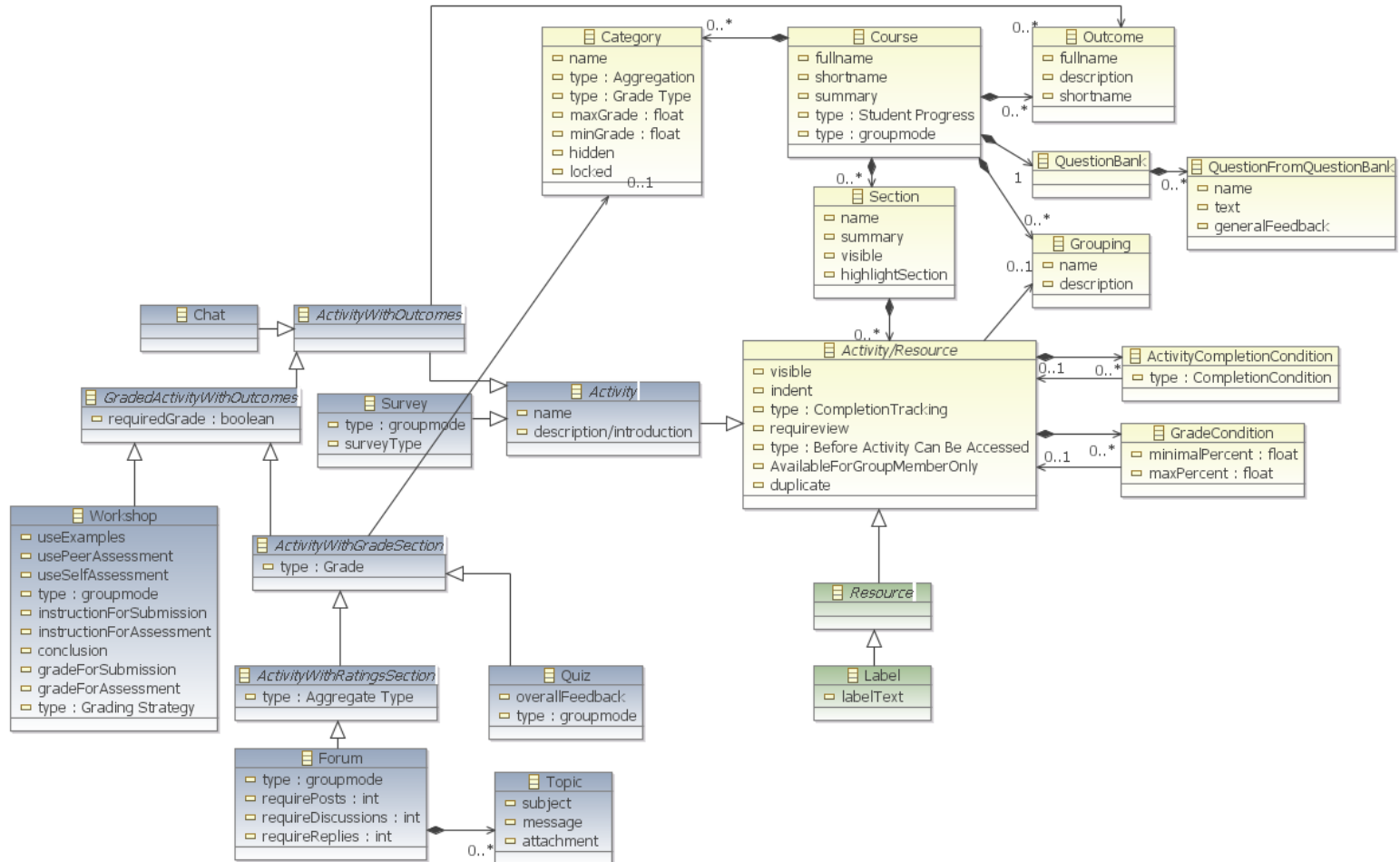
[List Icons]

Chemin:

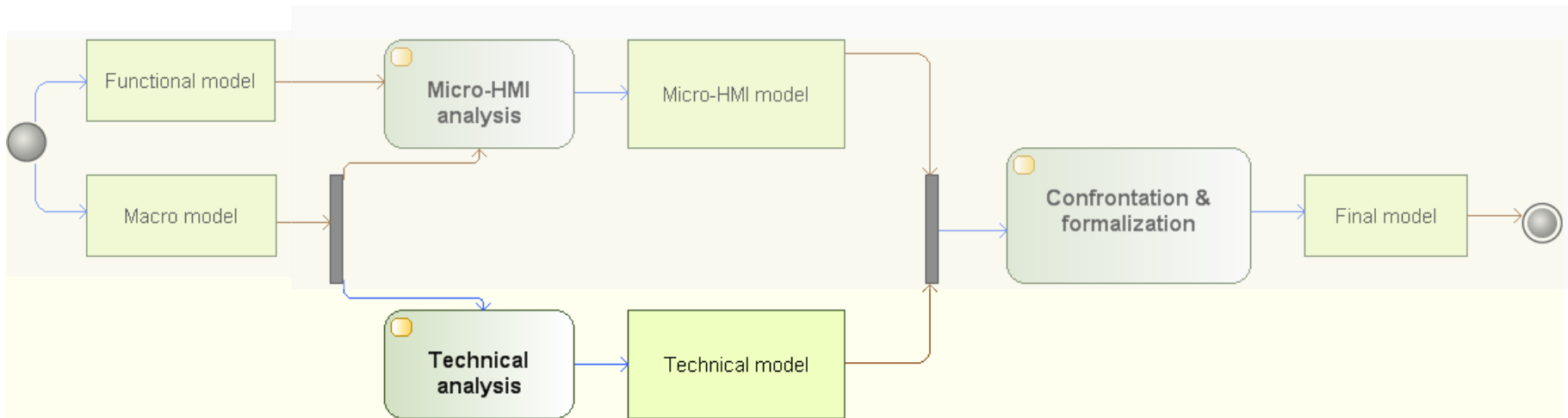
Mode d'abonnement

Suivi des messages lus

An extract of Moodle micro HMI model



The technical analysis (micro analysis)



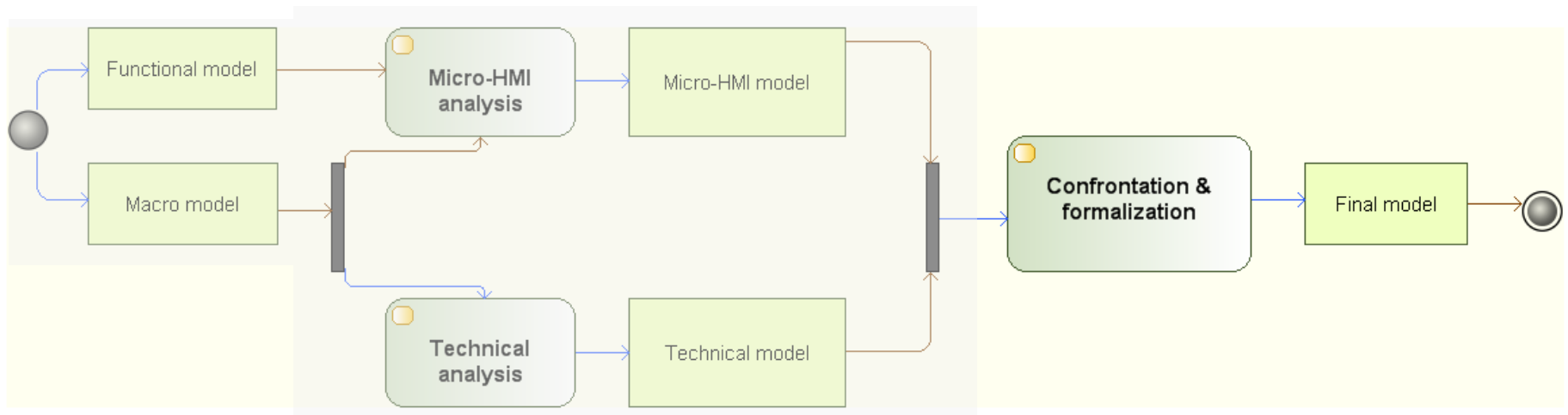
Objective : specify a reduced Conceptual Data Model from the one available by LMS providers.

Moodle 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
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

The Confrontation & formalization (micro analysis)



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

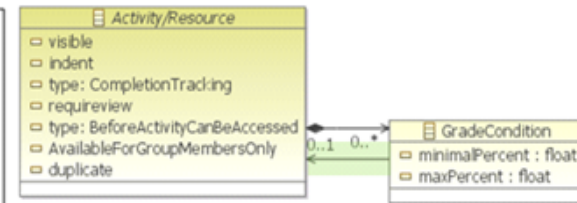
The Confrontation and formalization (micro analysis)

- 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.

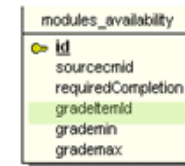
The Confrontation and formalization

```
// Check grade
if (!is_null($cm->completiongradeitemnumber)) {
    require_once($CFG->libdir.'/gradelib.php');
    $item = grade_item::fetch(array('courseid'=>$cm->course, 'itemtype'=>'mod',
        'itemmodule'=>$cm->modname, 'iteminstance'=>$cm->instance,
        'itemnumber'=>$cm->completiongradeitemnumber));
    if ($item) {
        // Fetch 'grades' (will be one or none)
        $grades = grade_grade::fetch_users_grades($item, 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}'");
        }
        $newstate = self::internal_get_grade_state($item, reset($grades));
        if ($newstate == COMPLETION_INCOMPLETE) {
            return COMPLETION_INCOMPLETE;
        }
    } else {
        $this->internal_systemerror("Cannot find grade item for '{$cm->modname}'
            cm '{$cm->id}' matching number '{$cm->completiongradeitemnumber}'");
    }
}
}
```

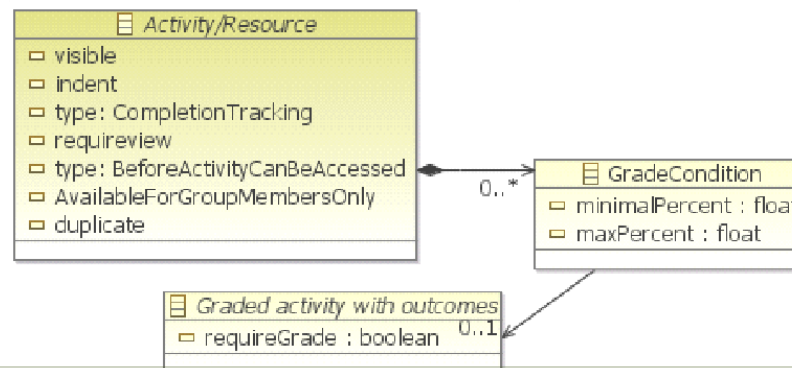
Part of the source code moodle/lib/conditionlib.php



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

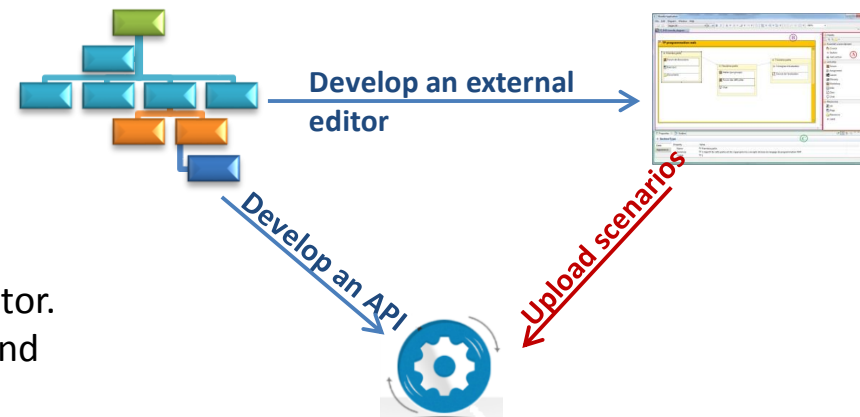


« GradeCondition » according to the technical analysis



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.



A method for identifying and formalizing the
underlying instructional design language of
existent LMSs

Thank you!

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