Specification of learning management system-centered graphical instructional design languages

A DSM experimentation about the Moodle platform
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Research context

- Laboratoire d'Informatique de l'Université du Maine (Le Mans, France)
- TEL engineering team
- 6-month explorative research work
- GraphiT project
  ➔ Funded by French research agency (ANR)
  ➔ Study expressiveness possibilities of operationalizable designing language
    ➔ Learning scenarios automatically deployed on LMS
Assumptions and objectives

✗ Assumptions:

➔ Institutions provide LMS to teachers and students
➔ Teachers are taught how to use functionalities
    ➔ Not how to design learning situations on LMS
➔ We can make explicit LMS embedded ID paradigm

✗ Objectives:

➔ Provide teachers with graphical learning design languages
➔ Use DSM to specify instructional design language and develop tools
➔ Encourage individual reflection about learning design
➔ Improve use of existing LMS
Visual Instructional Design Language

- To design learning scenarios
- Support creative thinking and human communication
- Do not systematically provide binding
  - Or through IMS-LD
- Classification according to L. Botturi et al.

<table>
<thead>
<tr>
<th>Language</th>
<th>Stratification</th>
<th>Formalization</th>
<th>Elaboration</th>
<th>Perspective</th>
<th>Notation</th>
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</thead>
<tbody>
<tr>
<td>EML</td>
<td>Flat</td>
<td>Semi-formal</td>
<td>Conceptual</td>
<td>Multiple</td>
<td>Visual</td>
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<tr>
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<td>AUTC</td>
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<td>Visual</td>
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<tr>
<td>IMS LD</td>
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<td>Formal</td>
<td>Specification</td>
<td>Single</td>
<td>Textual</td>
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<td>POEML</td>
<td>Layered</td>
<td>Formal</td>
<td>Implementation</td>
<td>Multiple</td>
<td>Visual</td>
</tr>
<tr>
<td>UML</td>
<td>Layered</td>
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<td>Conceptual / Specification</td>
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<td>Visual</td>
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</tbody>
</table>

A Classification Framework for Educational Modeling Languages in Instructional Design
L. Botturi M. Derml E. Boot K. Figl
Targeted instructional design language

✗ Graphical : visual formalism
✗ Operationalizable
  ➔ Formal
✗ Platform specific
✗ Implementation : LMS-centered design
✗ Specification : including teachers practices

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Scope

✗ One platform: Moodle
  ➔ Open-source, modular: easy to extend, customize
  ➔ Large community of users
✗ Domain Specific Modeling approach
✗ LMS meta-model already defined (Abedmouleh A.)
✗ Functional operationalization API
✗ Goal:
  ➔ Study DSM tools and techniques to specify a simple, yet useful, instructional design language
Methodology

Identify reusable pedagogical activities from teachers practices

Moodle hands-on experiments

Manual binding with Moodle concepts

Theoretical study of VIDL according to DSM

3 DSM approaches

Apply DSM approaches to binding

Results

Analyze results & prepare further work
Domain Specific Modeling

✗ Software development methodology
✗ Specific modeling language
✗ Code generation
✗ We use it to :
  ➔ Design the language
  ➔ Develop the tools
✗ Benefits :
  ➔ Cost reduction
  ➔ Easy to learn
Methodology

1. Identify reusable pedagogical activities from teachers' practices
2. Moodle hands-on experiments
3. Manual binding with Moodle concepts
4. Theoretical study of VIDL according to DSM
5. Apply DSM approaches to binding
6. Results
7. Analyze results & prepare further work

3 DSM approaches

Theoretical study of VIDL according to DSM

Moodle hands-on experiments

Manual binding with Moodle concepts

Identify reusable pedagogical activities from teachers' practices
Teachers needs and practises

✗ Pedagogical engineering team: Pôle Ressources Numériques (PRN)
  ➔ Maintain University moodle platform
  ➔ Teachers training
  ➔ Manual deployment of scenarios
  ➔ Strong skills in instructional design and Moodle use

✗ Online courses analysis

✗ Teaching materials analysis

✗ Need to asbtract from Moodle specific features
  ➔ Use of pedagogical activities as building blocks
Methodology

1. Identify reusable pedagogical activities from teachers' practices
2. Moodle hands-on experiments
3. Theoretical study of VIDL according to DSM

- Manual binding with Moodle concepts
- Apply DSM approaches to binding

Results

- Analyze results & prepare further work

- 3 DSM approaches
Example binding

Pedagogical activity

Self-assessment

Summative assessment

Moodle feature

Quiz

Adapative: true

Adapative: false

synchronous?

Debate

Chat

Forum

yes

no
Methodology

- Identify reusable pedagogical activities from teachers practices
- Moodle hands-on experiments
- Manual binding with Moodle concepts
- Theoretical study of VIDL according to DSM
- 3 DSM approaches
- Apply DSM approaches to binding
- Results
- Analyze results & prepare further work
First DSM Approach

- High priority: operationnalization
- Keep the Moodle Meta-Model
- Abstraction by visual notation
  - No dynamic binding
  - Numerous tools

Domain concepts:
- Chat
- Forum

Visual label:
- Synchronous debate
- Asynchronous debate

Chat → Forum → mapping

mapping → mapping
Second approach

✗ Extend Moodle Meta-Model
  ➔ With new pedagogical activities

✗ Generate non conform models
  ➔ Loss of compatibility with import API

✗ Code modification workaround

Diagram:
- Chat
- Summative assessment
- Forum
- Chat
- Quiz
- Forum

- Code modification

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Third approach

✗ Focus on teachers designing practices
✗ Platform independant metamodel
✗ Non conform models

➔ Use of model transformation (ATL)

- Debate (synchronous)
- Summative assessment
- Self-assessment

Model transformation

- Chat
- Quiz
- Quiz
Editors overview

Approach 1

Approach 2

Approach 3
Methodology

- Identify reusable pedagogical activities from teachers practises
- Moodle hands-on experiments
- Manual binding with Moodle concepts
- Theoretical study of VIDL according to DSM
- 3 DSM approaches
- Apply DSM approaches to binding
- Results
- Analysis & further work
## Analysis / comparison

<table>
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<tr>
<th>Criteria</th>
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<th>Approach 2</th>
<th>Approach 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual expressiveness</td>
<td>Too many elements (-)</td>
<td>Elements provided are coherent with teachers' needs but constraint (/)</td>
<td>Elements provided are coherent with teachers' needs (+)</td>
</tr>
<tr>
<td>Abstract expressiveness</td>
<td>Limited to the LMS one (-)</td>
<td>Limited to a close perimeter of the LMS one (/)</td>
<td>Non limited (+)</td>
</tr>
<tr>
<td>LMS Metamodel conformance</td>
<td>Direct (+)</td>
<td>Requires technical fine-grained adjustments at design time (/)</td>
<td>Requires complex coarse-grained transformations after design time (-)</td>
</tr>
<tr>
<td>Scenario semantics after import on LMS</td>
<td>Preserved (+)</td>
<td>Preserved but constraint (/)</td>
<td>Equivalent course / scenario can be inconsistent / incomplete (-)</td>
</tr>
</tbody>
</table>
Conclusion

✗ We specified a limited language, but useful:
  ➔ Tackle a first need of abstraction
  ➔ Raises the next issues

✗ 3 DSM approaches
  ➔ Approche 1 too limited
  ➔ Approche 2 costly and difficult to maintain
  ➔ Approche 3 complex to write, not effective
Further work

✗ Study and experiment on model composition
  ➔ Model merging: Epsilon Merging Language
  ➔ Model weaving: Atlas Model Weaver

✗ Other levels of abstraction
  ➔ Layered languages

✗ Include new Moodle features
  ➔ Conditional activities
Thank you for your attention

Questions?
Practises analysis

- Master IFUNO (EAD)
  - Teachers courses
  - Student courses

- PRN
  - PRN courses
  - Teachers courses

- GAPP
  - Meetings in Laval
  - Meetings in Le Mans

- IUT Laval
  - Teachers interviews

- Worldwide communities
  - LMS users
# Positionnement du projet

## e-learning

### initiation
- Aspects institutionnels
- Réflexions initiales sur besoins du cours ...

### conception

### gestion
- Inscription étudiants
- Répartition dans groupes

### diffusion
- Réalisation des activités par les apprenants, les tuteurs,

### évaluation

## Conception pédagogique (Instructional design)

### Conception générale du dispositif
- Public-cible
- Objectifs pédagogiques
- Objectifs du dispositif
- Approche pédagogique (différentiée, active, etc.)
- Démarche du dispositif (autoformation, séances obligatoires...)
- ...

### Spécification / scénarisation pédagogique

### implémentation

### opérationnalisation

### paramétrage

### Positionnement actuel
- A long terme

### Positionnement actuel
- A traiter dans projet

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- Session 2 Models
**Problématique DSM**

- Syntaxe abstraite : Méta-modèle
  - Formalise le métier des praticiens
  - Définit le format de persistance des modèles
    - Garant de la compatibilité avec la plateforme

- Syntaxe concrète : Notation graphique
  - Vue utilisateur final
  - Représentation graphiques des concepts métiers