Adaptability of Learning Objects

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Agenda

- Adaptability
  - Items, Factors

- Adaptability
  - of Navigation & Learning process
  - by using specifications /special XML Dialects

- Component Models to support Adaptability
Categories of Adaptability

Adaptability of
- ... presentation
  - kind, look and feel of the material
- ... contents
- ... learning process
  - dynamical process through varying sequence, selection of alternative learning paths
- ... the language (localization)
- ... navigation
- ... other functions of the learning system
  - confirmation/feedback of the system, help, automatically corrections

Adaptability – Influencing factors can be

- Person related
  - Adapt to the learner
  - Adapt to the teacher

- Issue related
  - Availability of resources
  - Adaptation to new or changed case studies

- Educational environment
  - Other courses / preknowledge
  - Curriculum, syllabus of the modules
  - Available time
Adaptations can occur

- Initial
  - Before starting to use a material or starting an interaction with the learner, all adaptations are carried out

- Permanent
  - At any time, an adaptation can change the material (at runtime 😊)

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Adaptability of navigation / learning process

movii.de (BMBF project)
Source: "Platform-independent publication of re-combinable learning objects based on XML", DeLFI conference 2003 (in German)

- multi-layered content hierarchy
  1. level: elementary content elements (txt, pic, animation, video, audio) combined to small, independent learning 'cores' (from the point of the learner the smallest self-contained learning content)
  2. these cores will be ordered thematically and combined in a hierarchy (flexible container structure)
  3. cores are networked with other core to packages, while other packages now can have different roles (knowledge consolidation, exercise, literature, case study, ...)
  4. through these packages, different learning paths can be defined

- this allows flexible recombination and modification of the learning materials

movii Model

Adaptability of e-Learning Material, Baile Herculane, Romania, 2005
Adaptability by using specifications / standards for learning design

- XML dialects:
  - LMML (LearningMaterialMarkupLanguage)
  - EML (EducationalModellingLanguage),
  - <ML>³ (Multidimensional LearningObjects and Modular Lectures Markup Language)
<ML³>: adaptability through

- Module Dimensions
- Didactic Concept
- Transformation Process

Source: www.ml-3.org

<ML³> Dimensions

- Target: Adaptability for learners - self tests, virtual experiments; teachers - didactic hints, sample solutions, suggestions for exams
- Intensity: deepness of the topic / the available time slot.
  - basic,
  - advanced
  - expert versions
- Output device:
  - slide - presentation in traditional face-to-face learning
  - online - full texts, multimedia and interactive components, navigation mechanisms
  - script - represents the printable equivalent of the online version, with static versions of dynamic multimedia.
<ML>³ Didactics

<ML>³ Transformations

Possible output formats: HTML (XHTML), PDF

Transformation process for the online version of a module:
- produces the table of contents (ToC)
- produces information for navigation (Nav)
- produces a number of presentation units (PUs) holding the content in well-presentable chunks.
Adaptability of presentation

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- Component Models to support Adaptability
Component Models for Learning Objects

- **SCORM content aggregation model**

- **Learnativity content model (Wagner 2002)**

- **ADL academic co-lab model**
  - Brown J. (2002). Academic ADL Co-lab. See also: [http://www.adlnet.org](http://www.adlnet.org)

- **Microsoft model**

- **CISCO RLO/RIO model**

*Source: Towards a Global Component Architecture for Learning Objects: A Comparative Analysis of Learning Object Content Models, Katrien Verbert, Erik Duval*
SCORM

- The SCORM content aggregation model contains the following components: Assets, Sharable Content Objects (SCO) and Content Aggregations.

- Assets are an electronic representation of media, text, images, audio, web pages or other data that can be presented in a web client.

- A Sharable Object (SCO) represents a collection of one or more assets. To improve the reusability, a SCO should be independent of its learning context. A SCO can for example be reused in different learning experiences to fulfill different learning objectives. SCOs are meant to be small units, such that reusability in more learning objectives is feasible.

- A Content Aggregation is a map (content structure) that can be used to aggregate learning resources in a well integrated unit of education (for example course, chapter, module, ...).

Learnativity Content Model (Duval & Hodgins 2003)

Modular Content Hierarchy

Corporate Wide

Application Specific Profiles

Reusability

Context

Most

Least

Shapes, Slides, Pictures, Textfields

Elements

Audio

Text

Illustration

Animation

Associated Slides

Section

Topic

JCSE Course

Adaptability of e-Learning Material, Baile Herculane, Romania, 2005
Learnativity content model

- **Raw Media Elements** are the smallest level in this model: these elements reside at a pure data level. (single sentence or paragraph, illustration, animation, etc.).
- **Information Objects** are sets of raw media elements. Such objects could be based on the “information block” model developed by Horn (Horn 1998).
- Based on a single objective, information objects are then selected and assembled into the third level of **Application Specific Objects** or learning objects in a more restricted sense.
- The fourth level refers to **Aggregate Assemblies** that deal with larger (terminal) objectives. This level corresponds with more conventional lessons or chapters.
- Lessons or chapters can be assembled into larger collections, like courses and whole curricula. The fifth level refers to these **Collections**.

The Microsoft Model and the Academic Co-lab Model are variants of this content model.
Suggestion for future work

- Transformation of our PowerPoint material in an independent XML format (perhaps based on <ML>³)
  - With support for different learning paths
  - With the possibility of easily exchanging parts of the content (case studies, examples, ...)
  - With different outputs (ppt, pdf, html, textbook ...)

- Building of a kind of repository / pool system for the learning objects and an authoring system for adaptable study packs or (e-)learning material based on the Learnativity Content Model / SCORM Model, perhaps there is a possibility to combine both approaches

† Towards a Global Component Architecture for Learning Objects: A Comparative Analysis of Learning Object Content Models, Katrien Verbert, Erik Duval

IMS / Learning Design

Possible to start developing from
- learning activities
- support activities
- environment
A Reusable Learning Object (RLO) is a collection of 7 ± 2 RIOs (Reusable Information Objects).

To make a complete learning experience or lesson from a collection of RIOs, an Overview, Summary and Assessment are added to the packet.

Reusable Information Objects (RIOs) are pieces of information that are built around a single learning objective. Each RIO is composed of three components: content items, practice items and assessment items.

- A practice item is an activity that gives the learner the ability to apply its knowledge and skills, like a case study or a practice test.
- An assessment item is a question or measurable activity used to determine if the learner has mastered the learning objective for a given RIO.
Comparative Analysis of Learning Object Content Models

- Content fragments are learning content elements in their most basic form, like text, audio and video. They represent individual resources uncombined with any other. A further specialization of this level will need to take into account the different characteristics of time-based media (audio, video and animation) and static media (photo, text, etc.).
- Content objects are sets of content fragments. They aggregate content fragments and add navigation. Content fragments are instances, whereas content objects are abstract types. We can extend content fragments with activities and people, and analogously content objects with activity types and roles. A content object assembles also other content objects.
- Learning objects aggregate instantiated content objects and add a learning objective. They define a topology between their components and can communicate with the outside world. Aggregations of learning objects can be made.
- No specification of the number of aggregation levels. It seems rather arbitrary to specify 3 or maybe 4 levels of aggregation.
Comparison table

<table>
<thead>
<tr>
<th>Model</th>
<th>Content Fragments</th>
<th>Content Objects</th>
<th>Learning Object</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCORM</strong></td>
<td>Assets</td>
<td>SCO</td>
<td>Content Aggregation</td>
</tr>
<tr>
<td><strong>Learnativity</strong></td>
<td>Raw Media</td>
<td>Information Object</td>
<td>Learning Object</td>
</tr>
<tr>
<td><strong>CISCO</strong></td>
<td>Content Items</td>
<td>RIO</td>
<td>RLO</td>
</tr>
</tbody>
</table>

Comparison of other Models

- Within the SCORM aggregation model, an asset can be associated with a content fragment. It is not clear where we should situate an SCO. SCOs are self-contained units of learning and communicate with an LMS. Furthermore, SCOs represent a collection of assets and can consequently be mapped on a learning object. On the other hand, SCOs cannot be broken down into smaller units. From this point of view, SCOs can be associated with content objects and content aggregations can be mapped on learning objects. In both ways, the SCORM content aggregation model fits within the constraints of the presented model.

- CISCO identifies RIOs, assessments, overviews and summaries, which can be mapped on content objects. An RLO is an aggregation of these components. As a result, the CISCO RLO/RIO model fits within the constraints of our model. The CISCO RLO/RIO model can be viewed as a specific profile of our model. It defines the components of a learning object more strictly: the model specifies that a learning object (RLO) contains 7 ± 2 RIOs, whereas the presented model does not restrict (the number of) components of a learning object.

- The learnativity model maps easily on the represented model. Raw media elements are associated with content fragments. Information objects like processes and procedures are abstract types like content objects. Learning objects and aggregations fit within the represented model. The three aggregation levels of the learnativity model (learning objects, aggregate assemblies and collections) come together in our model. The restriction of three levels of aggregation in learnativity seems very arbitrary.
Learning Technology Standards Committee:
Learning Technology System Architecture

The LTSA system components.