

Adaptive e-learning methods and IMS Learning Design. An integrated approach

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Abstract

This position paper shows how several classical methods in adaptive learning can be addressed using IMS Learning Design. After a definition of four main questions to classify adaptive educational methods we describe a group of features in the Levels B and C of the specification that make possible diverse types of adaptation.

1. Introduction and adaptive methods

In adaptive educational hypermedia a variety of research works about questions on how to adapt curricula and learning content to individuals and groups of learners has been done [1]. The application of adaptive methods to educational hypermedia applications can mainly be structured according to four main questions:

What parts or components of the learning process are adapted? This question focuses on the part of the application that is adapted by the adaptive method. Examples can be the pace of the instruction [2] that can be modified based on diagnostic modules embedded in the learning process or adaptation of content presentations, the sequencing of contents and others. Extensions with new forms of information delivery allow the distribution of learning materials to different learning contexts relevant to the individual user or groups of users.

What information does the system use for adaptation? In most adaptive educational hypermedia applications a learner model is the basis for the adaptation of the previously given parameters of the learning process. Nevertheless there are a several examples where the adaptation takes place not only to the learner knowledge, preferences, interests, cognitive capabilities, but also to tasks and learner goals.

How does the system gather the information to adapt to? There are a variety of methods to collect information about learners to adapt to. Mainly implicit and explicit methods like described in works from user modeling can be distinguished. A overview can be found at Jameson [3].

Why does the system adapt? This question mainly focuses on the pedagogical models behind the adaptation [4]. Classical educational hypermedia system mainly adapted according for compensation of knowledge deficits, ergonomic reasons, or adaptations to learning styles for an easier introduction into a topic.

Furthermore examples for adaptive methods can be found in different research areas as Intelligent Tutoring Systems [5], Adaptive User Interfaces [6], Adaptive Hypermedia [7], Intelligent Multimedia or Intelligent Agents [8] for Learning. Examples found in the literature can be mostly classified to the scheme introduced above. The following section will give an overview with some examples. In the following we will pick out some examples and discuss the possibilities to implement them in IMS Learning Design [9].

2. IMS LD and adaptive e-learning

IMS LD consists of three levels [10]. Each level itself provides specific features to the educational information pack, called Unit of Learning. Furthermore, Level A provides method, plays, acts, roles, role-parts, learning activities, support activities and environments; Level B provides properties, conditions, calculations, monitoring services and global elements; and Level C provides notifications. Every level is built on the previous one.

Besides the basic and crucial structure provided by Level A, the elements of Levels B and C become the actual key for adaptation, as they combine properties

with conditions and other features that encourage and make more flexible the content and the learning flow.

IMS LD is able to carry out six main types of adaptation [11]: *Learning flow based, content based, interactive problem solving support, adaptive user grouping, adaptive evaluation and changes in run-time*. They are also useful to address complementary issues to *adaptive learning, like active learning, collaborative learning, dynamic feedback, run-time tracking, ePortfolios and assessment* [12]. All these types of adaptation and specific applications to educational purposes make an intensive use of several features in Levels B and C, as we describe in the next section.

3. Elements in Levels B and C to model adaptive methods

The elements in Level B providing support to adaptation in Units of Learning are categorized as a) properties, b) conditions, c) global elements, d) calculations and e) monitoring services:

a) Definition, set-up and use of properties:

Properties are taken as variables to store values. There are several types of properties: local, local-personal, local-role, global-personal, global. There is also a property-group that is able to compile a number of the others.

b) Conditions: IMS LD is able to define a basic structure *if-then-else*, or multiple structure with several chained basic *if-then-else* in a row, for instance to change the value of a property or to show and hide one element.

c) Global elements: *Global elements* provide a communication flow between the *imsmanifest.xml*, where the different levels of IMS LD are set-up, and other XML files. Mainly, they can get an input from the user and they can show a value of a property. Furthermore, they can manage DIV layers in XHTML, for instance to show and hide specific content.

d) Calculations: IMS LD is able to make some basic arithmetic's (sum, subtraction, multiplication and division) and some combination of a number of them in a row, to get a more complex formula, like a simple average, for instance.

e) Monitoring service: The specification allows monitoring any kind of property assigned to a user or a role, for instance. In order to start this action, firstly the component *monitor* must be set-up inside an environment and later the property can also be monitored.

f) Notifications: An action is automatically launched depending on the state of a property or a

previous action, i.e., when a student ends an assignment an email is sent to the tutor.

4. Conclusion

IMS LD enables a standardized way for designing personalized learning experiences. The combination of *Properties, Conditions, Global Elements, Calculations and Monitoring services* allows modelling a variety of classical adaptive methods mainly based on environment, content, user groups and learning flow, such as reuse of pedagogical patterns, adaptability, navigational guidance, collaborative learning, contextualized and mobile distributed learning, adaptation to stereotypes. The forthcoming research on Level B and Level C aims to provide new expressive ways of modelling traditional adaptive e-learning.

5. References

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