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Modularization and Structured Markup for Web-Based Learning Content in an Academic Environment

Abstract: Modularization and Structured Markup for Web-Based Learning Content in an Academic Environment (ISBN 3-8322-4432-8)

The basic idea of a *learning object* is that it is a small, modular and self-standing chunk of learning content, which can flexibly be reused and assembled to electronic courses. Today, learning objects come in a variety of types of learning resources (lectures, presentations, reference material, simulations) and data formats (HTML, PowerPoint, Flash, Java, etc.). Most of the learning objects are individually designed and styled, and navigational and user interface controls are directly integrated into the objects. This phenomenon prevents a coherent assembly into larger learning units due to the inconsistencies in the graphical and navigational design.

In order to be able to successfully assemble learning objects from various origins into larger learning units, these objects must have similar *granularity* and they must be *self-contained*. Further, a standard data format separating contents from their visual presentation and navigation is needed. *Learning object component models* define different levels of granularity and specify how the components can be aggregated. *Structured markup*, using XML-based languages, provides a means to separate contents and visual presentation. The present work investigates learning object component models, the process to create modularized learning components, and structured markup for web-based learning contents.

The *dynamic Learning Content Management System (*dLCMS*)* project, presented in this work, defines and implements a learning object component model and structured markup. The level of granularity proposed is based on, what we call, *didactic content types* (e.g. definitions, examples, exercises, simulations, self-assessments). The suggested basic structured markup schema uses traditional typographical elements such as headings, paragraphs, lists, tables, etc. Because of its simplicity, it is anticipated to be easily understood by content authors and to be readily convertible to possible future data formats.

Content authors are a key factor for the successful application of these concepts. To support the authors to divide contents into learning objects representing a single didactic content type, the *Learning Unit Development Guidelines* have been developed as part of the dLCMS project.

A qualitative evaluation of the *dLCMS* and the *Learning Unit Development Guidelines,* together with content authors in an academic environment, focused on the modularization of learning contents and the application of structured markup. Authors from different scientific domains used the dLCMS to create a web-based learning unit for the education of students or university personnel. As a result, it can be concluded that the content authors understand the concepts of modularization. They are able to create self-contained modular building blocks of learning content which are based on didactic content types. These findings suggest that the process of creating such learning objects may foster the didactic quality of web-based learning units.

Additionally, a student evaluation of a learning unit composed of small, self-contained learning components was conducted. The evaluation investigated whether or not students perceive such learning units as didactically coherent. The results of the student evaluation show that students are able to easily detect the logical relationship between the self-contained learning objects. Thus, it may be concluded that it is possible to aggregate self-contained learning objects into larger didactically coherent learning units.

Hence, the dLCMS provides a simple and flexible component model. The granularity level of the basic building blocks is based on didactic content types which may be a basis to define a standard level of granularity. Together with the structured markup schema using standard typographical elements, and a schema for questions and tests, this framework allows contents from different

sources to be coherently aggregated into learning units. As a benefit of such a system, different authors and institutions can define a corporate styling of their e-learning courses, even if the original contents come from sources from all over the world.