

A Model for describing and structuring learning objects

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Abstract: *This paper presents how the learning objects are deployed in learning support environment. The design of content packages are described in the proposed model by integrating learning technology standards, specifications and instructional design theory.*

Key words: *learning support, learning object, content package*

INTRODUCTION

The process of developing many initiatives for the standardization of learning media has been affected by the aspiration of the developers to create an opportunity for a multiple use, transfer, and interchange of the learning objects and means using different learning support and management systems.

The current standards and specifications cover most of the aspects of a standard E-Learning architecture.

Based on them the authors develop "A Model for describing and structuring learning objects".

The main goal of the research is to describe and structure the learning objects used for developing a uniform learning support environment considered with the requirements of the existing Learning Object Metadata (LOM) of IEEE Learning Technology Standards Committee (LTSC) [3], Sharable Content Object Reference Model (SCORM) of Advanced Distributed Learning (ADL) [1] and the specification suggested by the Instructional Management System (IMS) [2].

The formulation of the specified goal results entirely from the aspiration for offering a research well-grounded in theory and tested in practice.

For achieving the goal thus set the results of the use of the suggested model are analyzed in the research and the efficiency and its applicability are substantiated in the "Learning support environment" developed.

During the development of the learning environment two basic problems were solved: What shall the learning environment include and which Web based technologies shall be used for its development.

SCORM Content Aggregation Model (CAM), SCORM Content Packaging, IMS Content Packaging Information Model, IMS Content Packaging XML Binding, Learning Object Metadata of IEEE and the Instructional design theory can be pointed out as fundamentals of the research work.

The Web technologies used in the environment are XML, HTML, Visual Basic, Visual Basic Script, Java script and C/C++.

E – LEARNING STANDARDS

In reply to the need of packaging the content a number of organizations have developed and approved several standards and specifications of the kind. They work on the definition of learning objects for multiple use, the development of new content models and the sequence of its use, models of evaluation of the learner's knowledge and development of "knowledge" databases and learning objects databases.

The SCORM2004 [1] standard outlines the main techniques of developing Web based learning environments. The goal is reaching a high level of learning systems requirements. It was achieved by including the LOM standard of IEEE [3] and the IMS specification [2] in this standard.

These standards need complementing for the instructional design theory application achieved with the model and programme implementation in a learning support environment suggested in the research.

A MODEL FOR DESCRIBING AND STRUCTURING LEARNING OBJECTS

The Model For Describing And Structuring Learning Objects was developed on the grounds of the existing standards and specifications for creation, management, development, and interchange of learning objects and means and the existing instructional design theory.

Using the model the developer of the course content shows the environment structure on figure 1.

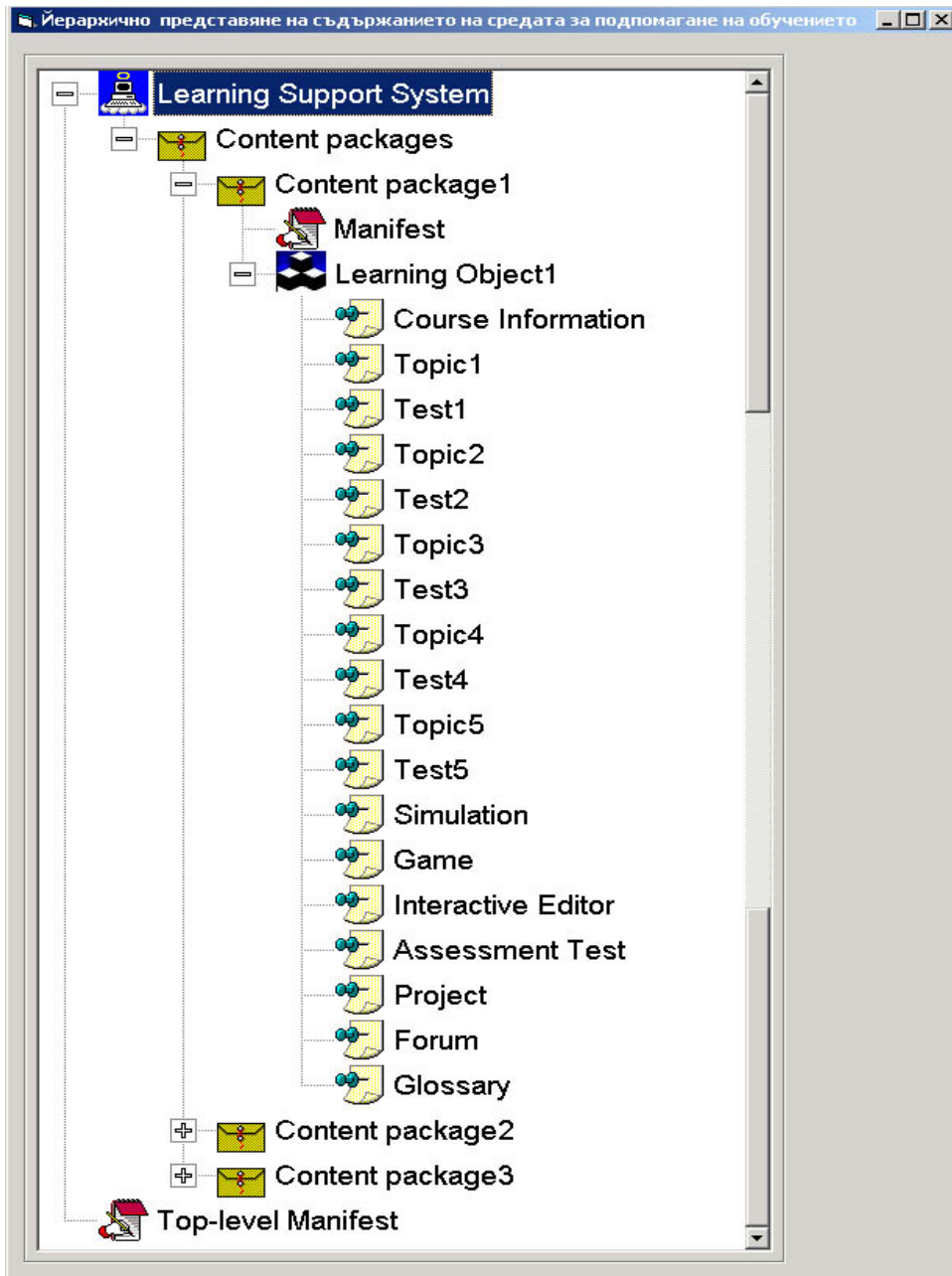


Figure 1. A hierarchical representation of the learning support environment content

The key aspects of the learning support environment have been presented in the following modules of the model:

Module 1: Content module – in conformity with the IMS Content Packaging Information Model [2] the text files, the multimedia content files, the files containing objects of evaluation, and all other physical files, which can be used in a learning environment, are a combination of means classified as “content”. These means cannot exist independently. Therefore they are described in an XML file called manifest.

It includes several learning courses:

Course 1 – programming on C/C++;

Course 2 – Web programming – it includes programming on HTML, VBScript, and Jscript;

Course 3 – programming on Visual Basic.

Each course is a basic independent structure called learning object.

The learning object is an independent element of a learning support system containing several modules, suitably annotated with meta-data and synthesized in a content package, in conformity with the existing standards – LOM (Learning Object Metadata) [3], SCORM (Sharable Content Object Reference Model) [1]. When the learner needs a specific information, he can look up in the course database and find it in one of the learning objects.

The learning object includes the following elements: an information of the course, a theoretical representation of the course subjects, simulations, games, tests, interactive editors, a project implementation, a forum, and a glossary. These elements represent separate physical files.

In the content package the learning object and the IMS Manifest file are set.

The Top-level Manifest includes the entire course organization.

Module 2: Content package – in conformity with the IMS specification the environment content package includes two components – an XML file describing the course structure, called `imsmanifest.xml` and the physical files forming the course structure.

The XML manifest file consists of the following components: meta-data, organizations, resources, and a sub-manifest of each separate environment course.

The meta-data are used for describing the content package and its characteristics in particular. The characteristics suggested by the Learning Object Metadata Standard [3] are used in the environment grouped in the following order: general, lifecycle, meta-metadata, technical, educational, rights, relation, annotation, and classification categories.

The learning objects stored in the Learning Repository can be found using the meta-data.

The organizations component shows the systematization of the course content. It includes several subcomponents describing the separate elements of the course.

It does not include a description of the physical files but ensures an information work frame guiding the user in the consecutive implementation of particular actions.

The resources component describes the physical files used in the learning course and the relations between them. It shows features different from the organizations component.

The physical files include the following content: a course information, a theoretical material, tests, simulations, games, an interactive editor, and a glossary.

The IMS specification [2] allows placing the content package in the Package Interchange File. It is a single compressed file which can be used in different learning systems.

By packaging the separate courses of the learning support environment presented in the research they can be used independently in learning management systems, learning support systems, etc.

Module 3: Instructional design – One of the components of the on-line learning environment playing a major part in their development is the strategy used by the theory – instructional design theory. Following that theory we can outline seven key processes for Internet learning included in the learning support environment.

- Modeling – the user has an opportunity to follow the implementation of a specific task step by step. A multimedia application is used for the purpose which enables the explanation and modeling process.

- A preparation for an independent implementation (coaching) – the places where mistakes at the programme implementation of the application assigned are most often made are presented to the user together with the methods of their avoidance.

- Scaffolding and fading – these are learning technologies, where the assistance rendered by the environment gradually reduces and the responsibility of the user for the development of an independent programme application increases.

The “Interactive HTML and Script Editor” tool included in the environment for the implementation of Visual Basic script code, given on figure 2, can be pointed out as an example of the implementation of the process described.

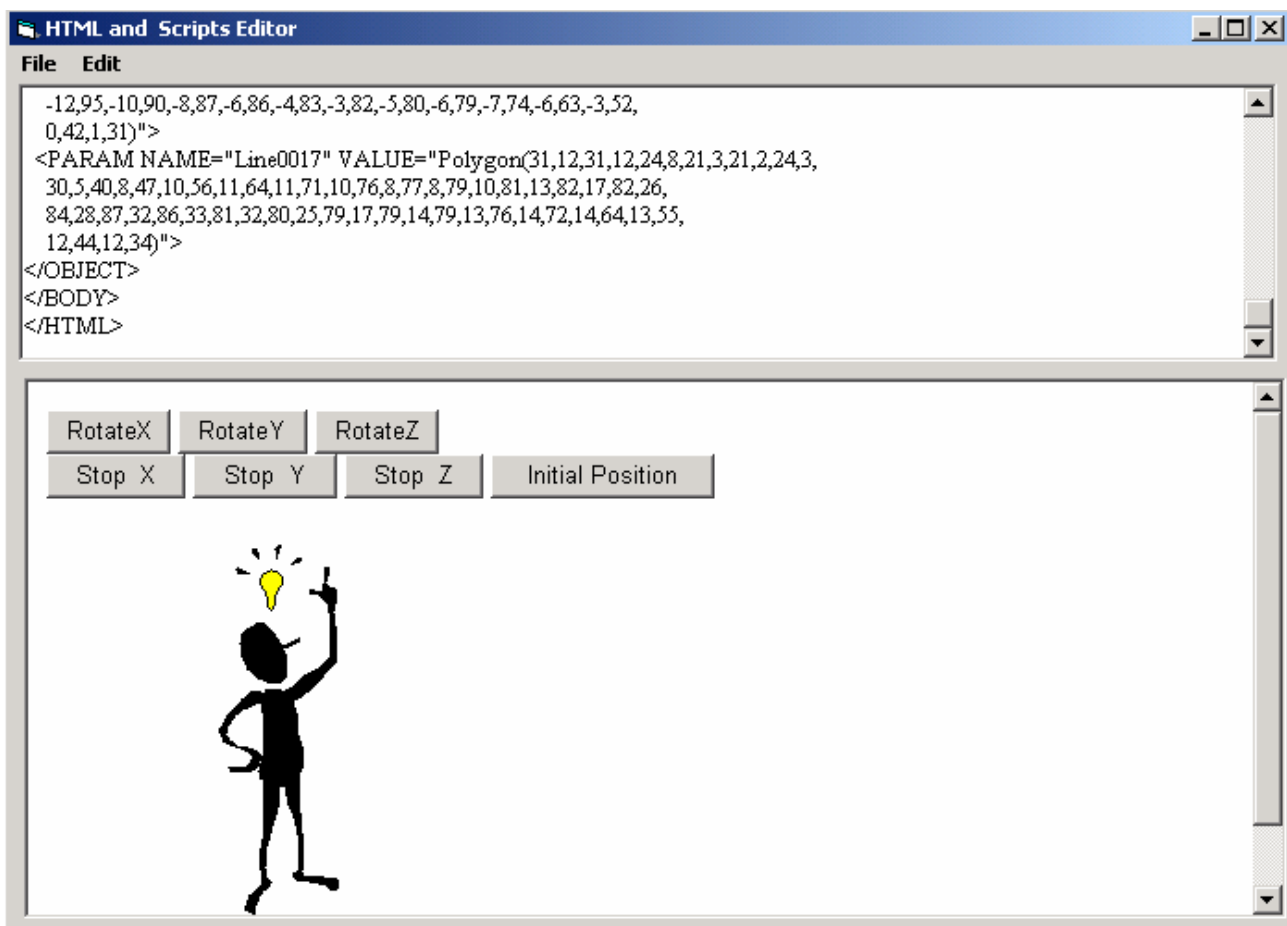


Figure 2 “Interactive HTML and Script editor”

- Articulation and reflection – the users need an analysis of their actions. One of the advantages of the learning environment presented is that it gives an opportunity of saving current actions and results for the purpose of implementing subsequent analyses.

When the user masters the respective course subjects, he is given “graded” evaluation tests of the knowledge acquired.

- Research – it contributes to the implementation of an independent examination of the learning environment. This process is implemented through the project module suggested. The user has an opportunity to choose between a project implementation using help on specific steps of its implementation or an independent implementation.

CONCLUSION

Using the “Learning support environment” an interchange and a multiple use of the learning materials can be performed. The learning objects, together with the metadata for them, form a content package, which can be set in the environment database. The metadata contain information of the course content, e.g. its title, the author, the file size where the lesson has been saved, the date it was created, and keywords. The metadata can be used for searching and filtering the information.

The environment allows a publication, a search, an interchange, and a multiple use of the learning objects to be carried out. Every learner has an access to the material appropriate to his requirements, interests, skills, etc.

The model suggested for structuring the learning objects can be applied as a whole or in separate parts of the learning assistance media which can be set by the teachers themselves without the intervention of the development teams.

The structures obtained as a result of the model application can be very useful at the development of learning management systems through developing a uniform “frame” of the system and its including in a particular semantics can be done later.

REFERENCES

[1] <http://www.adlnet.org/>

[2] IMS Instructional Management System project, <http://www.imsproject.org/>

[3] <http://ltsc.ieee.org/wg12/>

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