

INTRODUCING NEW ELEMENTS INTO THE SCORM STANDARD METADATA

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Keywords: e-learning, metadata categories, SCORM.

Abstract: In our recent research, through collecting and analyzing questionnaires filled out by users of e-learning resources, we have identified several useful metadata for describing such resources. In this paper we present our proposal of how to integrate those metadata into the SCORM standard. We propose to define two completely new categories for quality and reuse potential (reusability), and to put the other metadata into the categories already existing in the standard. We believe that our proposal, especially its fragment concerning the quality and reusability of e-learning resources, creates the direction in which SCORM should go in the near future.

1 INTRODUCTION

E-learning exemplifies those IT domains that have become extremely popular in recent years. That is a reason why the issue of standardization in the e-learning field is becoming more and more important. In one of our latest papers (Stasiecka et al., 2006) we have presented some results of our research on the problem of metadata in e-learning standards, especially in the SCORM 2004 standard (ADLNET, 2004). Those results include metadata and their categories that we identified during a statistical analysis of the data collected through our special questionnaire for users of e-learning resources. We identified several metadata that initially we categorized as: *Basic Specification*, *Didactics*, *Evaluation*, *Functionality*, *Usability*, *Environment*, *Formal Requirements*, *Reusability*, and *Quality*. Most of those metadata are completely new compared to SCORM 2004.

In our opinion, the most useful of our metadata categories are the following: *Didactics*, *Evaluation*, *Reusability* and *Quality*. The *Didactics* and *Evaluation* categories concern the conformance of the structure of an e-learning resource to the *model of effective learning* (Allesi & Trollip, 2001) and the evaluation of the learning process; *Reusability* and *Quality* concern the problems of the reuse potential and the quality of e-learning resources. We hope that

those categories may be especially helpful for those who need to decide which learning resource to use/reuse from several resources on the same/similar subject.

This paper presents the next step in our research. We incorporate our metadata discussed in (Stasiecka et al., 2006) into SCORM by extending the standard with two new categories for reusability and quality, and by putting the remaining metadata into appropriate already existing SCORM categories. In our opinion, both the new and modified elements may increase the usefulness of e-learning resources metadata and therefore they may be a useful part of the SCORM standard. Due to space limit, we concentrate only on some of the categories.

The paper is organized as follows. In its main part – Section 2 – we present our proposal of the new and modified metadata categories in the standard. Section 3 concludes the paper and outlines our future research.

2 NEW AND MODIFIED SCORM METADATA CATEGORIES

Below we present our proposal of incorporating the metadata identified in our research into the SCORM standard. We followed the presentation method in (ADLNET, 2004), but due to space limit we

concentrated on the following aspects of the metadata elements: textual description, multiplicity requirements, data type, and weight (a new aspect for some elements).

2.1 Modification to the SCORM Educational Element

We propose to extend the SCORM *Educational* category by introducing the following child elements:

- <didactics>
- <evaluation>

2.1.1 <didactics> Element

The <didactics> element groups elements representing the conformance of the resource to the model of effective learning.

Multiplicity Requirements: 0 or 1.

Data Type: The <didactics> element is a parent element; it contains the following child elements:

- <structure> – groups elements representing the conformance of the resource to the model of effective learning (based on the order and the proportions between the didactic components of level I and level II). **Multiplicity Requirements:** 0 or 1. **Data Type:** The <structure> element is a parent element; it contains the following child elements:
 - <modelConfLevel_I> – represents the conformance to the model of effective learning – for level I. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {very good, good, sufficient, insufficient, no conformance}.
 - <modelConfLevel_II> – represents the conformance to the model of effective learning – for level II. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {very good, good, sufficient, insufficient, no conformance}.
 - <quality> – represents the quality of the didactic components. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {very good, good, sufficient, insufficient}.

- <learningParadigm> – represents the prevailing learning paradigm used by the authors of the resource. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {lecture-based, problem-based, balanced}.

- <learningTime> – groups elements representing the expected (by the authors of the resource) time that the learner needs to work through the resource. **Multiplicity Requirements:** 0 or 1. **Data Type:** The <learningTime> element is a parent element; it contains the following child elements:
 - <effective> – represents the effective time of working with the resource (in hours). **Multiplicity Requirements:** 0 or 1. **Data Type:** Duration.
 - <continuous> – represents the time of working with the resource (in days); the time may include pauses. **Multiplicity Requirements:** 0 or 1. **Data Type:** Duration.

2.1.2 <evaluation> Element

The <evaluation> element groups elements representing the evaluation methods of: (1) the results of the learning process (it concerns the learner); (2) the usefulness and quality of the resource itself.

Multiplicity Requirements: 0 or 1.

Data Type: The <evaluation> element is a parent element; it contains the following child elements:

- <selfEvaluation> – groups elements representing the media supporting the learner's self-evaluation. **Multiplicity Requirements:** 0 or 1. **Data Type:** The <selfEvaluation> element is a parent element; it contains the following child elements:
 - <simulation> – represents the kinds of simulation supporting the learner's self-evaluation. **Multiplicity Requirements:** 0 or More. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {case studies, role playing, games, guided analysis}.
 - <drillAndPractice> – represents the kinds of questions supporting the learner's self-evaluation. **Multiplicity Requirements:** 0 or More. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {one-

- choice questions, multiple-choice questions, matching, jigsaw puzzles, open questions}.
- <problemQuestion> – groups elements representing the questions for the conceptual context of group problem-solving. **Multiplicity Requirements:** 0 or 1. **Data Type:** The <problemQuestion> element is a parent element; it contains the following child elements:
 - <solving> – represents the questions for testing the ability to solve the problems discussed in the resource, but in a new context. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {good quantity, sufficient quantity, insufficient quantity, no questions}.
 - <isolating> – represents the questions for testing the ability to isolate the characteristics of the beginning situation and of the expected situation. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {good quantity, sufficient quantity, insufficient quantity, no questions}.
 - <evaluating> – represents the questions for testing the ability to evaluate the solutions proposed by others. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {good quantity, sufficient quantity, insufficient quantity, no questions}.
 - <substantiating> – represents the questions for testing the ability to substantiate the solutions of problems. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {good quantity, sufficient quantity, insufficient quantity, no questions}.
 - <questionsStrategy> – represents the strategy of choosing questions. **Multiplicity Requirements:** 0 or More. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {fixed sequence, random, previous-answers driven, mixed, no questions}.
 - <feedback> – groups elements representing the existence of a feedback mechanism. **Multiplicity Requirements:** 0 or 1. **Data Type:** The <feedback> element is a parent element; it contains the following child elements:
 - <corrAnswFeedback> – represents the existence of correct-answer feedback. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {yes, no}.
 - <auxQuestFeedback> – represents the existence of auxiliary-questions feedback. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {yes, no}.
 - <reporting> – represents the existence of evaluation reporting. **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {yes, no}.
 - <questionnaire> – represents the possibility to evaluate the resource with the help of a questionnaire (e.g., questions about its quality). **Multiplicity Requirements:** 0 or 1. **Data Type:** Vocabulary. **Vocabulary Tokens:** The valid set of tokens is: {yes, no}.

2.2 New <reusability> Element

The *Reusability* category provides elements that describe the reuse potential of the resource, that is, the possibility to use it to create another e-learning resource.

Data Type: The <reusability> element is a parent element; it contains the following child elements:

- <useContext>
- <platform>
- <standard>
- <contactInfo>
- <reference>
- <user>
- <opinion>

2.2.1 <useContext> Element

The <useContext> element represents the context(s) in which the resource can be used.

Multiplicity Requirements: 0 or More.

Data Type: CharacterString.

2.2.2 <platform> Element

The <platform> element represents the platforms on which the resource has been tested.

Multiplicity Requirements: 0 or More.

Data Type: Platform (this data type has to be defined).

2.2.3 <standard> Element

The <standard> element represents the conformance of the resource to the standards.

Multiplicity Requirements: 0 or More.

Data Type: The <standard> element is a parent element; it contains the following child elements:

- <name> – **Multiplicity Requirements:** 0 or 1.
Data Type: CharacterString.
- <certificate> – **Multiplicity Requirements:** 0 or 1. **Data Type:** CharacterString.
- <date> – **Multiplicity Requirements:** 0 or 1.
Data Type: DateTime.
- <body> – **Multiplicity Requirements:** 0 or 1.
Data Type: CharacterString.

2.2.4 <contactInfo> Element

The <contactInfo> element represents the (author, technical support etc.) contact information necessary to use/reuse the resource.

Multiplicity Requirements: 0 or 1.

Data Type: Vocabulary.

Vocabulary Tokens: The valid set of tokens is: {very good, good, sufficient, insufficient}.

2.2.5 <reference> Element

The <reference> element represents the persons/institutions that recommend the resource.

Multiplicity Requirements: 0 or More.

Data Type: Reference (this data type has to be defined).

2.2.6 <user> Element

The <user> element represents the persons/institutions that have used or are using the resource.

Multiplicity Requirements: 0 or More.

Data Type: User (this data type has to be defined).

2.2.7 <opinion> Element

The <opinion> element represents opinions about the resource by its users.

Multiplicity Requirements: 0 or More.

Data Type: Opinion (this data type has to be defined).

2.3 New <quality> Element

The *Quality* category provides elements that describe the quality of the resource.

Currently, the weight of each element influencing the quality of the e-learning resource as a whole is 1. We plan to perform new statistical research with a new version of our questionnaire to establish real values for the weights.

Data Type: The <quality> element is a parent element; it contains the following child elements:

- <basicQuality>
- <searchSupport>
- <userSatisfaction>
- <expertAppraisal>
- <patternConformance>

2.3.1 <basicQuality> Element

The <basicQuality> element represents the quality of the resource with respect to the following categories: *Basic Specification, Didactics, Evaluation, Functionality, Usability, Environment, Formal Requirements, Reusability*.

Multiplicity Requirements: 0 or 1.

Weight: 1.

Data Type: Vocabulary.

Vocabulary Tokens: The valid set of tokens is: {very good, good, sufficient, insufficient}.

2.3.2 <searchSupport> Element

The <searchSupport> element represents the support to find information about the resource with the help of the resource's key words and classification.

Multiplicity Requirements: 0 or 1.

Data Type: Vocabulary.

Vocabulary Tokens: The valid set of tokens is: {very good, good, sufficient, insufficient}.

2.3.3 <userSatisfaction> Element

The <userSatisfaction> element represents the quality of the resource with respect to its user satisfaction aspect.

Multiplicity Requirements: 0 or 1.

Weight: 1.

Data Type: Vocabulary.

Vocabulary Tokens: The valid set of tokens is: {very good, good, sufficient, insufficient}.

2.3.4 <expertAppraisal> Element

The <expertAppraisal> element represents the expert appraisal of the resource by independent experts and/or authorizing bodies.

Multiplicity Requirements: 0 or More.

Weight: 1.

Data Type: ExpertAppraisal (this data type has to be defined).

2.3.5 <patternConformance> Element

The <patternConformance> element represents the conformance degree of the resource to the *pattern resource*, that is, to the resource whose quality with respect to didactics, evaluation, functionality, usability, reusability, user satisfaction and expert appraisal are considered to be optimal. This element is a derived one.

Multiplicity Requirements: 0 or 1.

Weight: 1.

Data Type: Vocabulary.

Vocabulary Tokens: The valid set of tokens is: {very high, high, low, very low}.

Stasiecka, A., Plodzien, J., & Stemposz, E., 2006. The Classification of E-Learning Resources Metadata: A Proposal. In *WEBIST'06, International Conference on Web Information Systems and Technologies*.

3 CONCLUSIONS AND FUTURE WORK

In the paper we have presented our proposal of how to integrate the metadata that we have identified in our research into the SCORM standard. We propose to define two completely new categories: *Quality* and *Reusability*, and to put the remaining elements into the existing standard categories. Because a lot of the metadata are either new or modified forms of SCORM metadata, we believe that they could become a useful part of the standard.

In our current and future work we plan to collect more data from users of e-learning resources and perform a statistical analysis on them. The findings of the analysis should enable us to further develop our proposal, especially, its part concerning the issue of the quality of e-learning resources.

REFERENCES

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