

Evaluation of Interoperability between MOT and regular Learning Management Systems

Fawaz Ghali and Alexandra I. Cristea

Department of Computer Science, University of Warwick,
Coventry, CV4 7AL, United Kingdom
{F.Ghali, A.I.Cristea}@warwick.ac.uk

Abstract. Adaptive Hypermedia content offers personalization; however, (re-)using such material with regular Learning Management Systems (LMS) is not yet straightforward. Ideally, materials created once should be usable anywhere. One such vehicle for reusability is represented by e-learning standards. Thus, here we describe the extension and evaluation of My Online Teacher (MOT), an adaptive hypermedia authoring system, to which compatibility with IMS Question and Test Interoperability (IMS QTI) and IMS Content Packaging (IMS CP) was added. This way, MOT authors can *use materials dedicated to learning process adaptation on any standards-compatible LMS*. In this paper we evaluate the converters from MOT to IMS CP and IMS QTI via both qualitative and quantitative analyses. This paper reports our hypothetical findings, their implementations, and the joint results of the evaluations of the converters. Finally, this work describes a significant step towards the little explored avenue of *adaptive collaborative systems*, based on extant learning standards and popular LMS.

Keywords: Interoperability, MOT, CAF, IMS QTI, IMS CP.

1 Introduction

Adaptive and adaptable hypermedia authoring is challenging, especially with respect to moving on from standalone academia systems and endeavoring to deliver the created adaptation materials to students using regular learning management systems (LMS). Previous studies [2] have shown that, whilst adaptation authoring is a “*difficult problem*”, there are at least two applicable approaches to solve it: 1) a *common language*, a lingua franca, used by all authors of Adaptive Educational Hypermedia (AEH); and 2) usage of *converters* between AEH systems. In the work reported in this paper, we follow a combined approach, by developing novel *converters* [4], which use authored adaptation materials as input and produce *standardized* material (the most widely accepted lingua franca) as output.

2 Evaluation of the Converters

The converters [4] have been tested with a group of about thirty 3rd year students of a course on “Web Programming”, who study Computer Science (FILS direction) at the Politehnica University Bucharest. The “Web Programming” course was partially delivered via two weeks of face-to-face lectures, seminars and hands-on labs, and for the rest of the term, delivered via distance learning. Before the students had to answer to questionnaires, they were made familiar, via *lectures*, with MOT [1] and CAF [3], Sakai¹, IMS QTI² and IMS CP³, and via hands-on *experiments*, with authoring environments (MOT) and TEL environments (e.g., Sakai). The students collaborated in the creation of new content in MOT and carried out conversions, visualized their own products, as well as other course material stored on Sakai.

Conversions from MOT to IMS QTI and IMS CP have been performed in two different sessions, on two different days. Each session started with a presentation on how the converter works, followed by a practical demonstration on using the converters. Then, it was the students’ turn to perform the conversions. Finally, the students had to evaluate their experience with the conversion systems, via questionnaires. Thus, the students played two roles in these evaluations;

- 1) the first role is ‘author’, where they created their own additional course materials in MOT and converted them to IMS QTI and IMS CP;
- 2) the second role as ‘student’, where they answered two separated questionnaires prepared in MOT and converted to IMS QTI.

For our testing purposes, it was reasonable to use students for the evaluations, as the type of system we envision towards the end of our developments will involve students as co-authors and collaborative annotators of the extant created material, in the sense of exploiting Web 2.0 techniques and trends in order to enrich and adapt material to the current student population. Thus, it is important that not only designers and educational material authors evaluate the authoring and conversion tools, such as we have done in the past, but also, that students can directly work with these tools.

2.1 Hypotheses of the MOT - CAF to IMS QTI Converter

The following set of initial design hypotheses were to be validated via the students’ answers, for the CAF to IMS QTI converter:

H1.1. Conversion to standards is useful for MOT: standards are vital in the context of test and quizzes for IMS QTI.

H1.2. The converter is ‘perfect’ for its purpose; students believe to learn it quickly (learning curve).

H1.3. The converter is ‘perfect’ for its purpose; students believe to be able to use it quickly (easy to use).

H1.4. The converter’s performance is adequate; time for response is acceptable (perceived user acceptance).

¹ <http://sakaiproject.org/>

² <http://www.imsglobal.org/question/>

³ <http://www.imsglobal.org/content/packaging/index.html>

H1.5. The converter's performance is adequate; `time < 30 sec` for a regular UNIX server supporting multiple server processes, 2GB of RAM and 3GHz of dual CPU, for a small CAF questionnaire file (about 5 concepts with 10 attributes in total).

H1.6. The converter converts all required information from CAF.

H1.7. The converter should cover all types of questions (not just fill-in-the-blanks, as in our experiment).

H1.8. The converter is well-integrated with the other programs (that it is used with).

2.2 Hypotheses of the MOT to IMS CP Converter

The following set of design hypotheses were to be tested via the students' answers, for the CAF to IMS CP converter:

H2.1. Conversion to standards is useful for MOT: standards are vital in the context of learning contents for IMS CP.

H2.2. The converter is 'perfect' for its purpose; students believe to learn it quickly (learning curve).

H2.3. The converter is 'perfect' for its purpose; students believe to be able to use it quickly (easy to use).

H2.4. The converter's performance is adequate; time for response is acceptable (perceived user acceptance).

H2.5. The converter's performance is adequate; `time < 30 sec` for a regular UNIX server supporting multiple server processes, (2GB of RAM and 3GHz of dual CPU), for an average CAF course file (about 20 concepts with 100 attributes).

H2.6. The converter converts all required information from CAF.

H2.7. The converter is well-integrated with the other programs (that it is used with).

H2.8. CAF to IMS CP conversion is more appropriate than CAF to IMS QTI.

2.3 Quantitative Analysis of the Hypotheses

We prepared two obligatory questionnaires based on our hypotheses, in which we asked eleven questions about the MOT to IMS QTI converter and twelve questions about MOT to IMS CP converter. Due to lack of space in this paper, we have placed the questionnaires (including the questions and answers) online⁴.

We applied a Chi-square test to verify if our observations match our hypotheses. We chose the chi-square test because our questionnaires used categorical data. The degrees of freedom associated with our data are calculated as follows:

$$Df = \text{number of categories} - 1$$

The Chi-square (X^2) values represent the associations between the answers of each question, i.e., X^2 will be larger if the observed results diverge from those expected by chance. As shown in Table 1 (for the MOT to IMS QTI converter) and Table 2 (for