QUESTION AND TEST INTEROPERABILITY: AN UPDATE ON NATIONAL AND INTERNATIONAL DEVELOPMENTS

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Abstract

Will the question banks you are creating be accessible in future years when the assessment system you use is no longer supported? Can student assessment data be transferred from your assessment system to your institution's student records systems? Interoperability is, or should be, of concern to all those serious about implementing CAA. The IMS Consortium is developing standards for the interoperability of educational systems. A significant part of the Consortium's work concerns question and test interoperability (QTI). Version 1.1 of the QTI specification was produced in 2000 and is beginning to be adopted by software developers. This paper examines the latest enhancements to the IMS QTI specification and plans for its future development. It also reports on the work of the JISC-funded CETIS QTI Special Interest Group which is bringing together UK CAA developers and implementers across further and higher education.

Introduction

International developments in specifications for storing and transferring assessment data currently centre around IMS (www.imsproject.org), a major consortium which has taken the lead in developing specifications for online learning systems. The IMS Question and Test Interoperability (QTI) Working Group published version 1 of its specification in May 2000 (Smythe and Roberts, 2000). This specification examines an exchange between item banks and looks in particular at the anatomy of an item. It comprises three documents: an information model, a best practice guide and an XML binding. A further document, the QTI Lite specification, was developed for vendors who

wish to implement simple assessment systems but do not require the complexity of the full specification.

Simple and complex assessment

Online assessment can be a relatively simple process. You can for example provide learners with a fixed set of questions, one after the other. There might be a textual prompt followed by several choices, only one of these being the correct answer. The user selects one answer for each question and the program adds up the number of correct answers to provide a total score for the test.

For many testing purposes, this model is adequate. However requirements within higher and further education can be considerably more demanding. For example, assessments may be scored on more than one dimension. The Selection and Ordering section of version 1.2 of the specification will incorporate this. The method of interaction, including presentation material and user input was described in v1.0 and has been updated in version 1.2. Response processing, dealt with in v1.0, specifies ways of dealing with responses to individual items. Outcome processing concerns generating the of outcomes of an entire test and is dealt with in v.1.2.

ASI

The primary QTI specification has become known as ASI: Assessment, Section and Item. Items refer to the individual questions and associated answers and other data. Sections group together one or more items and provide a way of dividing a test into separate parts. Assessments comprise one or more sections or items.

Some of the question types it is possible to implement using ASI are as follows:

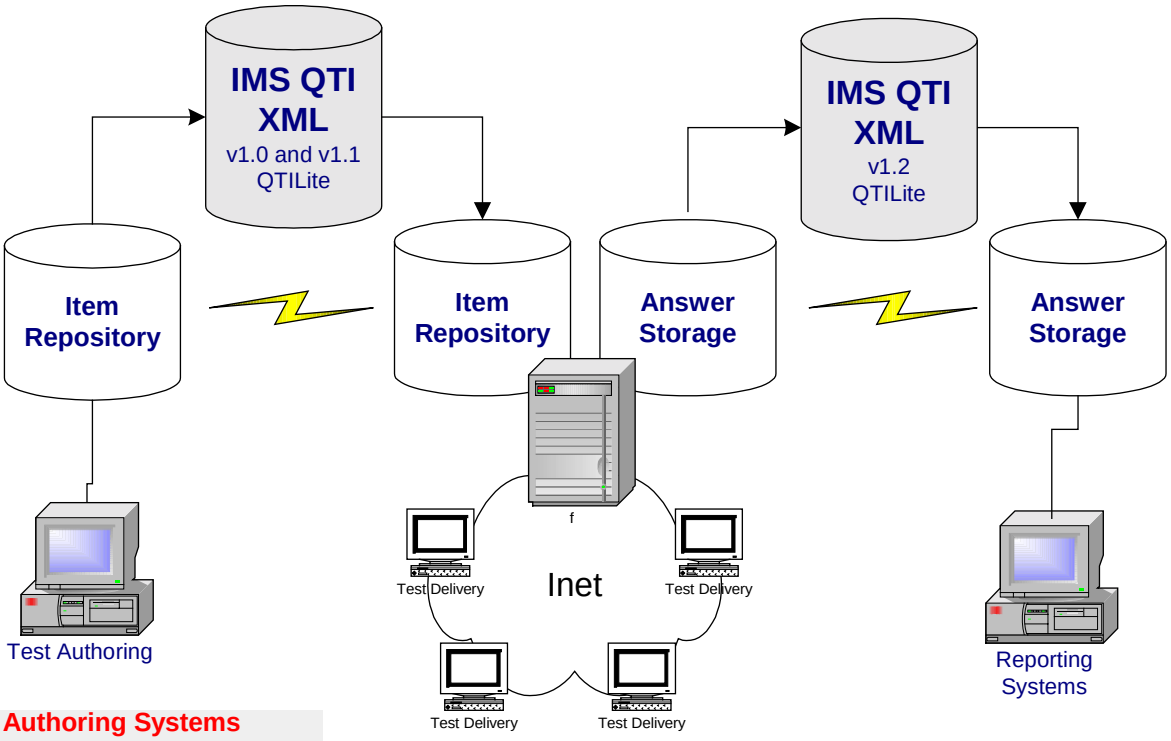
- Multiple choice
- True false
- Multiple response
- Image hot spot
- Fill in the blank
- Select text
- Slide
- Drag object
- Drag target
- Order objects
- Math item
- Connect the points

Which *city* is the capital of *England* ?

- ○ Sheffield
- ◉ London
- ○ Manchester
- ○ Edinburgh

Which *city* is the capital of *England* ?

One of the key breakthroughs in ASI has been the ability to separate the logical type from the render type. Thus the following question "Which city is the capital of England?" is specified logically in the same way for each of the two examples above, the render type being the main difference.



Schematic representing example uses of the QTI data formats

Results

The second part of QTI refers to Results. Recent efforts of the Working Group have been devoted to this part of the specification. Some interesting issues have emerged. Summarising results assumes an outcome processing model which might, for example, require the adding up of all the correct answers. Outcome processing assumes a selection procedure such as selecting all the items. The difficulty comes when ASI has to somehow communicate these requirements to the delivery system.

Sequencing and selection

Recent work has also considered the selection and ordering of items and sections. Selection refers to the choice of one or more items or sections. Ordering determines the order in which they are presented to the participant. The selection rules are typically different from those employed by learning management systems.

Presentation

Presentation was defined in v1.0 and enhanced in v.1.1. It uses tags for material and for a number of “controls” which set response variables.

Response and outcome processing

ASI refers to the way an assessment is constructed, delivered and scored. However, one of the problems with XML is that it is not normally appropriate for specifying algorithms. Most assessments are processed using one of a small number of algorithms. QTI will refer to these algorithms by name but will not attempt to describe them in XML. Up until now QTI has not provided any implicit interpretation of variables set by response processing at the item level. However, outcome processing must map these variables to input parameters.

It is not impossible to use XML for the specification of algorithms. QTI Response processing has a set of tags for the algorithmic processing of responses - principally to allow complex conditional processing of multi-response and multi-choice questions.

Current implementations

A number of vendors have stated that they will build systems which conform to QTI. Amongst these is Questionmark (www.questionmark.com) which has produced a free tool which allows the transfer of assessments between QTI and Questionmark. The Scottish Computer Assisted Assessment Network (www.scaan.ac.uk) produced a web-based authoring tool which enables the

creation of simple assessments conforming to v1.0. A community of developers is beginning to use these tools to test the interoperability of their own systems.

Harmonisation within IMS

Harmonisation with the other specifications is now being tackled by IMS. The IMS Content Packaging specification will need to be able to incorporate ASI data with other learning materials. Results of assessments will need to be passed to the Profiles and Content Management specifications. Another working group is looking at metadata; ultimately QTI metadata should be harmonised with general IMS metadata. Increased usage of vocabularies and standard XML representation will be introduced across the specifications.

Further refinements to QTI

Other refinements that would enhance the specifications would include addressing some of the complex presentation issues currently ignored. Ideally there would also be support for advanced algorithms. Finally, some aspects of the specifications need to be clarified and perhaps simplified.

Standards

IMS is not currently producing standards and is leaving these to standards bodies such as ISO and IEEE. However neither of these institutions is currently working in the QTI area (IMS, 2000). The development of high stakes assessment tools would benefit from formal testing against a standard. There is a growing demand for standards in this field and QTI could develop to satisfy this demand. In a related initiative, the British Standards Learning Technology Committee panel is already developing a standard (BS 7988) for "using information technology in delivering assessment" (www.bsi-global.com). This will have wide applicability across HE, FE and schools sector in the UK and may form the basis for an ISO standard in this area.

UK Developments

The UK is heavily represented within the IMS QTI Working Group. There are also a number of related initiatives taking place within the UK. The Joint Information Systems Committee (JISC) has provided funding for a Special Interest Group through the Centre for Educational Technology Interoperability Standards (www.cetis.bangor.ac.uk). The CETIS QTI SIG is coordinated by the University of Strathclyde and is engaged in a wide range of activities to promote interoperability for online assessment across UK further and higher education. These include:

- Holding a number of face to face meetings and video conferences to discuss areas of mutual interest
- Maintaining online discussions

- Jointly developing a range of open source tools to implement the QTI specifications and providing a central repository for these tools
- Hosting a number of workshops to inform the wider HE and FE communities of the latest developments on issues surrounding interoperability and assessment.

The CAA Centre continues to promote CAA in the UK and has strong links with the SIG in the area of interoperability and assessment.

Conclusion

It would seem that there is now a strong future for IMS QTI. With partners such as IBM, Blackboard and Questionmark playing key roles in the development of the IMS specifications it is likely that the Consortium will continue to lead the way in certain areas of online learning, in particular that of QTI, where there is no equivalent work taking place elsewhere. IMS is working closely with SCORM, another large initiative funded by the US Department of Defence and the recently announced Open Knowledge Initiative, led by Stanford and MIT, which is committed to developing open standards for learning technology. Both of these initiatives may integrate large parts if not all of the IMS QTI specification. There is now an urgent need for developers and vendors to implement the specification in order to realise the considerable benefits of interoperability for themselves and their customers.

Acknowledgements

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References

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