

Quickscan QTI - 2006

Usability study of QTI for
The Digitale Universiteit (DU)

Pierre Gorissen

20 November 2006



Colophon

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Date

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Reference

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Summary

In 2003 *The Digitale Universiteit (DU)* performed a quickscan to determine the usability of the IMS Question and Test Interoperability (QTI) specification as a format to store questions and tests developed for and by the consortium. That quickscan was carried out by Pierre Gorissen (P.Gorissen@Fontys.nl) and the original report is still available in Dutch from the website of *The Digitale Universiteit (DU)*: <http://www.digiuni.nl/publicaties/>. The unofficial translation of that report is available for download from <http://www.gorissen.info/Pierre/QTI>.

Now, in 2006, *The Digitale Universiteit (DU)* commissioned an update of this quickscan to find out to what extent the support has changed/improved in the course of those three years.

The update of the quickscan uses the same set of requirements and test items as in 2003, but looked at a smaller subset of, newer versions of the applications tested in 2003: Respondus, QuestionMark Perception, N@tschool!, Blackboard, Learn eXact.

In addition to this test with QTI 1.2 items, the quickscan also explains the differences between that version of QTI and the currently available 2.1 version. Since none of the applications in use within *The Digitale Universiteit (DU)* and the base set to be tested currently support version 2.1, the TOIA system was added to the set of tested applications. It not only has QTI 1.2 import and export functionality but also has support for QTI 2.0 items. Only its QTI 2.0 import functionality has been tested.

Conclusions

Based on the results of this and the previous quickscan, a number of conclusions have been formulated:

- The quickscan shows no significant increase in support for QTI by the systems involved in this quickscan. This despite the clear overview of issues that was provided by the 2003 version of the quickscan and the obvious business need for better interoperability.
- The TOIA system did not perform significantly better while importing the QTI 2.0 items when compared with the systems importing QTI 1.2 items.
- The converted test set covered only a small part of the actual QTI 2.1 functionality.
- Systems in general provide poor feedback when trying to import QTI items. This makes 'fixing' items where the import fails almost impossible.

Recommendations

The quickscan makes two recommendations:

- The level of support for QTI, or any other interoperability specification that enables the exchange of assessment items has not significantly improved during the last three years. Apparently the market does not yet see the importance of that and their customers fail to explain that need to them. This calls for more explicit actions from funding bodies like *The Digitale Universiteit* to require use of tools that assure interoperability of the developed assessment materials.
- Developing good import and export functionality for QTI is not easy and it is a waste of time if each and every vendor has to develop support for that on an individual basis. The educational community would be much better (less expensive) off if an open source reference implementation of this functionality is built. This open source implementation enables vendors to look at an example of how to implement the needed functionality so that they can adapt their systems accordingly.

Despite the results in this quickscan, the recent developments in new systems that were built taking IMS QTI in account suggests that a future update of this quickscan (in 2009?) might paint a different picture.



1 Introduction

This is an update of the QTI Quickscan as performed in 2003. The aim of this update is to get an overview of the changes in support for QTI since 2003 within the consortium of The Digitale Universiteit (DU). Besides testing the support using the same QTI 1.2 test set that was used in 2003, a converted set in QTI 2.0 format was created.

1.1 About The Digitale Universiteit (DU)

The Digitale Universiteit (DU)¹ is a consortium of ten universities in the Netherlands. It was founded to focus on the development and application of digital products, both software and content, and knowledge. Together, the affiliated institutions represent over 30 percent of the students enrolled in the Dutch higher educational system. Yearly some 500 professionals are working together in many projects. The results are publications, websites and online products for the (Dutch) higher education.

For more information about The Digitale Universiteit see the website which has both a Dutch and an English section: <http://www.digiuni.nl/>

1.2 Conditions

For this quickscan a number of conditions were formulated:

- This quickscan uses IMS QTI 1.2 to test against the applications in the base list
- The applications in the base list are:
 - Respondus 3.5 (in 2003 version 2.0.2 was tested)
 - QuestionMark Perception online QTI conversion system and the Perception Authoring Manager version 4.1.1.0 (in 2003 version 3.4.0.2 was tested)
 - N@tschool! 9.0 Summer Edition + Accelerator Pack (in 2003 version 7.0 UP2 was tested)
 - Blackboard 6.3.1.5.7.4 (in 2003 both version 5.5 and 6.0 were tested)
 - Learn eXact 3.0 (in 2003 version 1.7 was tested)
- The quickscan uses a converted set items in IMS QTI 2.1 format to test against:
 - TOIA
- Only the import of QTI items is tested, as a base for the test, the same QTI 1.2 test set as in 2003 will be used.
- The quickscan was scheduled to take no longer than 60 hours.

1.3 Project team

The quickscan study was carried out by Pierre Gorissen, Fontys University of Applied Science. Main contact for the DU was Jan Rasenberg (Rotterdam University), project manager for the project 6048: Use of test repositories in VLE's (6048: *Gebruik van toetsbanken in ELO*)

1.4 Deliverables

The quickscan consists of:

- a report in English with the results of the quickscan;
- a set of QTI files in QTI 1.2 format that can be used to test QTI import;
- a set of QTI files in QTI 2.1 format that can be used to test QTI import.

Unlike the 2003 version, this report is available in English only. Because of that the test sets, though they still relate to Dutch subjects, have been translated also.

The files and the report can be downloaded from: <http://www.digiuni.nl/publicaties/> or from the website of the author: <http://www.gorissen.info/Pierre/QTI>. The 2003 version of the report is also available on both websites.

¹ Note: Universities in the Netherlands in general either choose to provide a translated name of their university or choose to not translate the name into English and simply use it as a brand. The Digitale Universiteit choose the first option and doesn't use *The Digital University* even though that would be a correct translation into English.



1.5 Acknowledgements

This quickscan wouldn't have been possible without the contributions and the help of a number of people. In alphabetic order I want to thank:

- Pascal van de Biggelaar of Threeships Enterprises for answering my questions related to the current QTI support in N@tschool! ,
- Marten Douma from INHOLLAND for the access to their Blackboard server,
- John Kleeman from QuestionMark for the access to the QuestionMark Perception online QTI conversion system and the Perception Authoring Manager version 4.1.1.0 and for answering my questions related to the QTI support in QMP,
- Jan Rasenberg from Rotterdam University for his comments on the draft version of this quickscan,
- Jalshan Sabir from Strathclyde University and Satish Krishna from Excel India for the access to the TOIA system and for answering my queries related to that system,
- David Smetters from Respondus for answering my questions related to the QTI support in Respondus 3.5

1.6 About the author

Pierre Gorissen is a consultant working for the Educational Development department of the Fontys University of Applied Science in Eindhoven, the Netherlands. Fontys is a member of *The Digitale Universiteit* consortium. Through his work for the SURF Foundation he has been actively involved in a number of project groups developing specification within the IMS Global Learning consortium.

Currently he is one of the co-chairs of the IMS QTI 2.1 development team, together with Steve Lay of the University of Cambridge.

Easiest way to get in contact with Pierre is by sending an e-mail to P.Gorissen@Fontys.nl.



2 Question and Test Interoperability Specification (QTI)

When trying to reuse educational content in different VLEs, there are a couple of options. The first one is to print out all the content and enter them again in the second VLE by hand, or more advanced, using cut and past to do it the digital way. As soon as the amount of content grows a bit, that isn't a feasible option. A second method could be to build an interface between the VLEs so they can look into each other's databases and retrieve the content there. If the number of VLEs involved however grows, the number of interfaces and thus the complexity grows rapidly. These first two options probably still account for the most case of actual exchange of assessment materials. However, the third option, agreeing on a common open exchange format developed by a neutral organization, not by a single vendor, is arguably the most cost effective one in the long run.

The Question and Test Interoperability Specification (QTI), developed by the IMS Global Learning Consortium, is such a neutral exchange format for questions (items), groups of related questions (sections) and complete assessments. It also is an exchange format for the results reports of those assessments.

2.1 IMS Global Learning Consortium, Inc.

IMS Global Learning Consortium, Inc. (IMS) is developing and promoting open specifications for facilitating online distributed learning activities such as locating and using educational content, tracking learner progress, reporting learner performance, and exchanging student records between administrative systems. IMS has two key goals: Defining the technical specifications for interoperability of applications and services in distributed learning, and supporting the incorporation of the IMS specifications into products and services worldwide. IMS endeavours to promote the widespread adoption of specifications that will allow distributed learning environments and content from multiple authors to work together (in technical parlance, "interoperate")². The first IMS specifications were released in 1999; at the moment there are a dozen specifications available:

- IMS AccessForAll Meta-data Specification - Version 1
- IMS Reusable Definition of Competency or Educational Objective Version 1.0
- IMS Content Packaging Specification Version 1.2
- IMS Digital Repositories Specification Version 1
- IMS Enterprise Specification Version 1.1
- IMS Enterprise Services Specification Version 1
- IMS ePortfolio Specification - Version 1
- IMS General Web Services Specification - Version 1
- IMS Learner Information Package v1.0.1
- IMS Learning Design Version 1.0
- IMS Meta-data Specification Version 1.3
- IMS Question & Test Interoperability Version 2.1
- IMS Resource List Interoperability - Version 1
- IMS Shareable State Persistence - Version 1
- IMS Simple Sequencing Version 1.0
- IMS Vocabulary Definition Exchange - Version 1

The version numbers show that some of the specifications are relatively new, and have been added to the ones listed in the 2003 version of the quickscan, while others have gone through a number of revisions based on input from the field. For each specifications an information model (describes what is in the specification), a XML binding (describes the technical implementation) and a best-practice and implementation guide (advise about how to use and implement the specification). The documents can be downloaded or read online, free of charge, at the IMS website: <http://www.imsglobal.org/>

2.2 QTI 1.2 v.s. QTI 2.0 and QTI 2.1

Since the release of QTI version 1.2 the specification has been updated in two stages. First, the item part of the specification has been updated, resulting in the QTI 2.0 specification. After that had been completed the sections, assessment and result reporting functionality of the QTI 1.2 specification were updated also and, together with the QTI 2.0 specification, that was combined into the QTI 2.1 specification.

This quickscan will use both files in the IMS QTI 1.2 format (for the base set of applications) and files in the IMS QTI 2.1 format (for the TOIA system). Whenever in this quickscan the acronym QTI without version number is used, it is done to refer to the specification in general. In all other cases, the version number, either QTI 1.2 or QTI 2.1, will be used to identify which version is being discussed.

² Source: <http://www.imsglobal.org/>



A QTI item can conform to either QTI 2.0 and QTI 2.1 or just QTI 2.1 if it uses features introduced in that latest version. An assessment can only conform to QTI 2.1 but can contain both QTI 2.0 and 2.1 items.

2.3 QTI 1.2

The first official release of the Question and Test Interoperability (QTI) specification dates from June 2000. At the moment the QTI 1.2 version is still the most widely implemented version of the specification. This is the version used in the 2003 version of the quickscan and also for the base set of applications in this 2006 version of the quickscan. The base structure of version 1.2 files look like this:

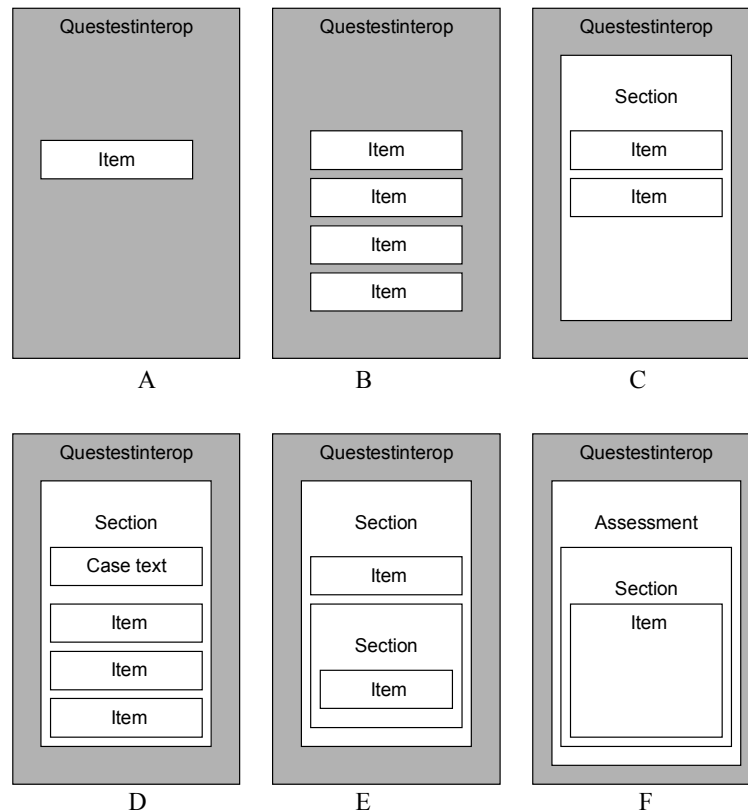


Figure 1 A couple of possible QTI constructs

A QTI 1.2 file contains an XML tree, with root <Questestinterop> and might contain a single question (A), or a couple of individual questions (B). If you want to use a case text with a couple of related questions, the file might look like (C) or even (D). Sections can contain both items and other sections (E). Those sections can then be grouped to an assessment (F). An assessment can't just contain individual items; they have to be contained within a section. On the next page you can find see simple XML implementation of such a QTI 1.2 file. It is a simple multiple-choice question with one correct answer:

Which of the following people has not yet been prime minister of the Netherlands?
 A) Wim Kok
 B) Ruud Lubbers
 C) Wouter Bos
 D) Dries van Agt
 E) None of the above

Example 1 a simple multiple-choice question

Since this is a question that is probably hard to answer for readers not from the Netherlands, and since this question has been used as the base for almost all of the files in the test set (in both the QTI 1.2 and QTI 2.1 files), it might be useful to tell that the correct answer to the question is **C) Wouter Bos**.



The QTI 1.2 XML example shown below does not yet contain response processing, scoring of the answer and showing feedback. That would have made the listing more complicated and longer. The files in the test set do contain those elements.

```
<questestinterop xmlns="http://www.imsglobal.org/xsd/ims_qtiasivlp2"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.imsglobal.org/xsd/ims_qtiasivlp2 ims_qtiasivlp2.xsd">
  <qticomment>
    A simple multiple choice question.
  </qticomment>
  <item title="QTI_MC_101" ident="QTI_MC_101">
    <presentation label="QTI_MC_101">
      <flow>
        <material>
          <mattext> Which of the following people has not yet been prime minister of
the Netherlands?</mattext>
        </material>
        <response_lid ident="MC_101_Q01" rcardinality="Single" rtiming="No">
          <render_choice shuffle="Yes">
            <flow_label>
              <response_label ident="A">
                <material>
                  <mattext>Ruud Lubbers</mattext>
                </material>
              </response_label>
            </flow_label>
            <flow_label>
              <response_label ident="B">
                <material>
                  <mattext>Wim Kok</mattext>
                </material>
              </response_label>
            </flow_label>
            <flow_label>
              <response_label ident="C">
                <material>
                  <mattext>Wouter Bos</mattext>
                </material>
              </response_label>
            </flow_label>
            <flow_label>
              <response_label ident="D">
                <material>
                  <mattext>Dries van Agt</mattext>
                </material>
              </response_label>
            </flow_label>
            <flow_label>
              <response_label ident="E" rshuffle="No">
                <material>
                  <mattext>None of the above </mattext>
                </material>
              </response_label>
            </flow_label>
          </render_choice>
        </response_lid>
      </flow>
    </presentation>
  </item>
</questestinterop>
```

Example 2 XML QTI 1.2 implementation of a simple multiple choice question

You of course don't want to expose the item author to this kind of complex XML. Instead you would want to provide them with a user-friendly application that creates this XML. But that is the subject of a different test.



2.4 QTI-Lite 1.1

Because the QTI 1.2 specification was rather complex, IMS also came up with a lite version (QTI-Lite 1.1). The lite version has fewer options, making it easier to implement for a vendor. The lite specification can, like the other specifications, be downloaded from the IMS website: <http://www.imsglobal.org/question/#qtilite>. If a file is QTI-Lite conformant, then it automatically also is QTI conformant. For this quickscan the relevant differences between the two specifications are that QTI-Lite does not have support for:

- essay items
- fill in the blank items
- the <hints> or <solutions> element
- metadata
- sections and assessments
- the elements <flow></flow>, <flow_mat></flow_mat> and <flow_label></flow_label>

Because both the version of Learn eXact tested in 2003 and the current 3.0 version of Learn eXact only supports QTI-Lite and not the full specification, an extra QTI-Lite test set has been created base on the original set of files. The conversion process wasn't complex: a couple of question types simply weren't supported (fill in the blank, essay) so those files couldn't be converted. In all other files the elements <flow></flow>, <flow_mat></flow_mat> en <flow_label></flow_label> were removed from the remaining files. That was enough to make them QTI-Lite 1.1 conformant.

2.5 QTI 2.0 / 2.1

Since the QTI specification was first conceived, the further development of in particular the IMS Content Packaging, Simple Sequencing, and Learning Design specifications created the need for a cross-specification review. Also, as the implementations of QTI matured, particularly during the phase of development between versions 1.1 and 1.2 of the specification, a number of issues have been raised that could not be addressed without making substantial changes to the specification. There was considerable pressure from the QTI community to address these issues with a revised version of the specification. Although some of the issues related to the addition of functionality, in particular support for some new items types in common use, many of them related to improving the data model generally to provide more scope for conformance testing and better integration with modern approaches to rendering QTI content in assessment delivery engines. The review took place during 2003 and coincided with the production of the first QTI quickscan. In September that year a project charter was agreed to address both the collected issues from 1.x and the harmonization issues and to draft QTI 2.0.

In order to make the work manageable and ensure that results were returned to the community at the earliest opportunity some restrictions were placed on the scope of the recommended work. Therefore, the QTI 2.0 release of the specification was released in January 2005 and concentrated only on the individual assessment items. It did not update those parts of the specification that dealt with the aggregation of items into sections and tests or the reporting of results. The QTI 2.1 release, in June 2006, completes the update from version 1.x to version 2.x by replacing those remaining parts of the QTI specification. The June 2006 release was labelled Public Draft (revision 2) and not yet Final Version. The reason for that is that the increase of importance given to the availability of at least one reference implementation of specifications released by IMS. Despite the draft status, the specification is currently (October 2006) considered ready for implementation.

The example on the next page shows the same example as was given for QTI 1.2, but this time with both the response processing, the correct answer and the modal feedback included in the XML.



```
<assessmentItem xmlns="http://www.imsglobal.org/xsd/imsqti_v2p0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.imsglobal.org/xsd/imsqti_v2p0
http://www.imsglobal.org/xsd/imsqti_v2p0.xsd" identifier="QTI_MC_2p1_110"
title="QTI_MC_2p1_110" adaptive="false" timeDependent="false" label="QTI_MC_2p1_110">
  <responseDeclaration identifier="MC_110_Q01" cardinality="single"
baseType="identifier"/>
  <outcomeDeclaration identifier="FEEDBACK" cardinality="multiple"
baseType="identifier"/>
  <outcomeDeclaration identifier="SCORE" cardinality="single" baseType="integer">
    <defaultValue>
      <value>0</value>
    </defaultValue>
  </outcomeDeclaration>
  <itemBody label="QTI_MC_2p1_110">
    <p>Item QTI_MC_2p1_110: Which of the following persons is not or has not been Prime
Minister of the Netherlands?</p>
    <choiceInteraction responseIdentifier="MC_110_Q01" shuffle="true" maxChoices="1">
      <simpleChoice identifier="idA" fixed="true">
        <p>Ruud Lubbers</p>
      </simpleChoice>
      <simpleChoice identifier="idB" fixed="true">
        <p>Wim Kok</p>
      </simpleChoice>
      <simpleChoice identifier="idC" fixed="true">
        <p>Wouter Bos</p>
      </simpleChoice>
      <simpleChoice identifier="idD" fixed="true">
        <p>Dries van Agt</p>
      </simpleChoice>
      <simpleChoice identifier="idE" fixed="true">
        <p>None of the above</p>
      </simpleChoice>
    </choiceInteraction>
  </itemBody>
  <responseProcessing>
    <responseCondition>
      <responseIf>
        <match>
          <variable identifier="MC_110_Q01"/>
          <baseValue baseType="identifier">idC</baseValue>
        </match>
        <setOutcomeValue identifier="SCORE">
          <baseValue baseType="integer">1</baseValue>
        </setOutcomeValue>
        <setOutcomeValue identifier="FEEDBACK">
          <multiple>
            <variable identifier="FEEDBACK"/>
            <baseValue baseType="identifier">Correct</baseValue>
          </multiple>
        </setOutcomeValue>
      </responseIf>
    </responseCondition>
  </responseProcessing>
  <modalFeedback outcomeIdentifier="FEEDBACK" showHide="show" identifier="Correct">
    <p>That is Correct!</p>
  </modalFeedback>
</assessmentItem>
```

Example 3 XML QTI 2.1 implementation of a simple multiple choice question

The example contains all the basis elements of a QTI 2.1 assessment item: response declaration, outcome declaration, item body, response processing and in this item (modal) feedback.



2.5.1 Changes made in the QTI 2.1 specification

This section gives a brief overview of the great number of changes that have been made in the 2.0 and 2.1 version of the QTI specification.

2.5.1.1 Re-alignment with other IMS specifications

IMS Contentpackaging Specification

Prior to QTI 2.0 there was no recommended or predefined way of *packaging* resources when transferring items, tests or processing templates between systems. This often caused problems when for example items used images or animations as part of the item. Starting version 2.0 of the specification, the use of IMS Content Packaging for this is required.

The QTI specification requires no modifications or extensions to the existing Content Packaging data model, features of that specification are used in the way originally intended. The goal was to enable the use of content packages containing assessment objects with the existing base of tools (package editors, repositories etc.) that support IMS Content Packaging without modification³.

IMS Learning Resource Meta-data Specification

Previous versions of the IMS QTI specification had a QTI specific meta-data set contained within the data structures of the items and assessments themselves. That set of meta-data elements had names which all started with the characters 'qmd_'.

In QTI 2.0, this QTI-specific meta-data has been brought into line with the IEEE Learning Object Metadata (LOM) standard in accordance with the IMS Meta-data Best Practice and Implementation Guide for LOM. The IEEE LOM standard defines a set of meta-data elements that can be used to describe learning resources, but does not describe assessment resources in sufficient detail. The application profile provided in the QTI 2.x specification extends the IEEE LOM to meet the specific needs of QTI developers wishing to associate meta-data with items as defined by the accompanying Item Information Model.

The alignment with the IMS Content Packaging specification also meant that the meta-data was moved out of the individual QTI items and into the *imsmanifest* file that is part of the Content Package and is the place to describe the resources in the package. This enables existing repositories and tools to read/write at least the generic part of the meta-data for items and assessments.

IMS Learning Design Specification

The IMS Learning Design 1.0 specification offered placeholders for use of an external assessment model like IMS QTI as part of the Units of Learning that are defined within IMS Learning Design. The IMS QTI 2.x specification describes the use of IMS Learning Design properties and IMS QTI variables as a way to integrate both specifications.

2.5.1.2 Changes in the Item Content model

The new version 2.0 and 2.1 introduced a number of changes to the item content model.

XHTML

One very noticeable change compared to QTI version 1.2 is that the content model for the items now is restricted to a well defined subset of XHTML. Use of plain text or RTF is no longer allowed. Though this might seem as a more restrictive, it is much clearer defined, can be validated against the QTI schema and is easier to implement. Through support for the object-element and MathML-support the model is still flexible enough to cater for most needs.

Content that needs to be available in multiple items can be shared using Xinclude allowing for another way to optimize the content development and maintenance.

Interactions

The combination of response types and rendering types that was used to determine how an item should be rendered in QTI 1.2 has been replaced by a system of interactions⁴: *endAttemptInteraction*, *inlineChoiceInteraction*, *textEntryInteraction*, *associateInteraction*, *choiceInteraction*, *drawingInteraction*,

³ For more details see: http://www.imsglobal.org/question/qti2p1pd2/imsqti_intgv2p1pd2.html#section10003

⁴ For a more detailed description of the interactions see:
http://www.imsglobal.org/question/qti2p1pd2/imsqti_infv2p1pd2.html#section10076



extendedTextInteraction, gapMatchInteraction, graphicInteraction, hottextInteraction, matchInteraction, medialInteraction, orderInteraction, sliderInteraction, uploadInteraction

These interactions can be used in any combination within an item allowing for very complex items. The customInteractions allows for the use of interactions not covered by the current QTI information model.

Adaptive items

Especially in formative assessments finding the correct answer to a question often isn't something that needs to be limited to just one single attempt. In those cases the process of discovering the correct answer is as important and finally finding it. An adaptive item allows for multiple attempts and can change the feedback, displayed information according to the number of attempts, the selection option etc.

It even is possible to display additional interactions for example to help the candidate solving parts of the question.

Item templates

A lot of items in formative and summative assessment are variations on common structures. For example if an item is designed to test if a candidate can multiply two numbers between 1 and 10, it isn't very efficient to by hand create items for all possible combinations of a multiplication of two number between 1 and 10.

In QTI 2.x the item designer can create one single item template that describes this multiplication question. That template can then be cloned, either during run-time or at any given time to the needed set of items to be used in an assessment.

Inline feedback

The introduction of inline feedback, where the feedback is displayed as part of the original item allows for much more flexible design of stimuli for the candidate. Especially if the item is adaptive, inline feedback can be valuable because the item designer can choose whether feedback given for the previous attempts stays visible for the candidate as part of the item body or not.

Because inline feedback can also contain new interactions it can also be used to have a candidate solve parts of the problem if his previous attempts have shown that he didn't fully understand the complete question.

Number formatting

In many types of items the formatting of the numbers used in both the item, the feedback and the response by the candidate can be very relevant. QTI 2.0 en 2.1 offer extensive number formatting capabilities.

2.5.2 Changes on Assessment level

The QTI 2.1 version introduced a number of changes and enhancements on assessment and section level

Item reference

Without a doubt a very visible change is the fact that the XML of an assessment item is no longer included in the XML of the assessment. Instead the items are referenced from within the assessment.

The advantage is that if one single item is used in three assessment, the XML file of the item is now simply references from within the assessment. Updates to that item only need to be done once in the external item file where in version 1.2 any change made to an item also needed to be made in each and every assessment file where that item already was in use.

Pre-conditions and Branching

QTI 2.1 offers the assessment designers both pre-conditions determining whether an item should be displayed as branching options that determine which items should be displayed based on either the score or selected answer option of the previous item.

This allows for the creation of adaptive assessment that adapt the difficulty of the next item based on the performance of the candidate so far in the assessment. It also enables the use of items as 'selector-items' for example as an assessment where the candidate has to demonstrate to know the best combination of steps to take to solve a problem.

2.5.3 Implementation related changes

A final category of changes relates to support for implementers and system designers.

Conformance model

QTI version 2.0 introduced a conformance model that enables a system vendor to provide an overview of the conformance level of the system.



Implementing and supporting QTI version 2.x doesn't involve simply implementing all or none of the features provided by the specification. A vendor can decide for example to start by implementing the most requested interaction types, or to add all interaction types, but not support adaptive items, or to support only a restricted set of response processing templates, not to support MathML etc.

The level of implementation can be described in an XML model provided by the specification.

Also, by using an XSLT it is possible to create a profile of a QTI version 2.x item and determine if it requires features not provided by the system.

Full validation of items and assessments possible

Because the XHTML used in the item body is part of the schema provided by the specification, it is possible to validate the complete item and or a complete assessment for both well formed XML and the use of not allowed elements.

Response processing templates

The implementation of response processing functionality that covers the full richness of the response processing that can be used within a QTI 2.x item can be to big a challenge at first for a system vendor.

The specification defines three basic yet powerful response processing templates. If a system supports at least those three, it can choose to limit the implementation efforts of the building process while still enabling basic response processing functionality.

Use of external response processing

In some cases the response processing can be too complex to describe in QTI and/or might require the use of external systems. This could also be the case if an item needs to be scored by a human instead of a computer. The QTI specification allows for the use of references to these external response processing engines.

QTI Lite

As with QTI 1.2, the QTI 2.x specification also defines a Lite version, which is basically a profile that limits the number of available options.

3 The test set and the testing process

This chapter covers the structure of the test set, the applications that have been tested and the test cycle itself.

3.1 The QTI 1.2 test set

In 2003 it was considered unnecessary, to test all the possible options of the QTI 1.2 specification during the quickscan. Therefore the test set concentrated on a subset of functionalities based on the requirements of the project Law Online (*Rechten Online*) to create a set of items that tested a number of functionalities.⁵ A more detailed overview of the files in the QTI 1.2 test set can be found in Annex A.

3.2 The QTI 2.1 test set

The QTI 2.1 test set was created by converting the QTI 1.2 test set to 2.1 format by using the QTI migration tool version 20060915⁶. The Python version of the tool was used since that was the most recent version available at the time of the quickscan.

After conversion the files were checked and edited using XMLSpy. All comments added by the conversion script were deleted and were needed some small manual adjustments were made to the items.

It must be noted that the QTI 2.1 test set is not the optimal set for testing the level of support for QTI 2.1 in an application. First of all, as the profile for the items in Annex B shows, only a subset of QTI 2.1 functionality is being tested. Also, because the items are created as result of a best effort by the migration tool based on the QTI 1.2 XML, the resulting XML isn't always the most compact, optimised version.

3.3 The applications that have been tested

Unlike during the first quickscan no review round was performed since this time *The Digitale Universiteit (DU)* had a much clearer view of the applications it wanted to be tested. The application tested will be briefly introduced in this section.

3.3.1 Respondus 3.5

Respondus started off as an application to create questions and assessments for the Blackboard and (the not in this quickscan included) WebCT, eCollege and Angel VLEs. Respondus can import and export QTI 1.2 files. That means you could download questions created in Blackboard into Respondus and then upload them into WebCT or save them as QTI files and vice versa. For this you don't need to change anything on the server of the VLE. All Respondus needs is some information about the server (URL for the login page, username and password etc.). Respondus can then show what courses you've got access to, what assessments there are etc. In this quickscan Respondus is used in combination with Blackboard 6.3.1.5.7.4

Website: <http://www.respondus.com/>

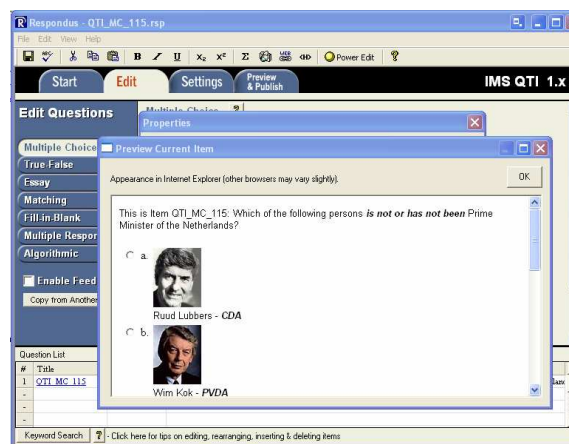


Figure 2 Respondus 3.5

⁵ Please see the 2003 version of the quickscan for a more detailed description of the creation of the QTI 1.2 test set.

⁶ For download options see:
http://qtitools.caret.cam.ac.uk/index.php?option=com_docman&task=cat_view&gid=18&Itemid=28

3.3.2 QuestionMark Perception 4.1.1.10

QuestionMark Computing Ltd., the company behind QuestionMark Perception, was closely involved in the development process of the IMS QTI specification. QuestionMark Perception specializes on the development of assessments and questionnaires on the Internet or an intranet. Tests can be served from the Perception server and the results can be analysed using the Enterprise Reporter. For *The Digitale Universiteit (DU)*, QuestionMark Perception is the official application to be used for assessments. For this quickscan, QuestionMark provided access to the Perception Authoring Manager version 4.1.1.10 and its new online service that converts QTI items to Question Marks own QPack format. Although the previous version 3.4.0.2 of the Authoring Manager was able to import the QTI 1.2 test set that uses a reference to the XSD to validate the files, the version 4.1.1.10 requires the use of the DTD. For this quickscan therefore the online service was first used to convert the QTI 1.2 test set to QPack format. The Perception Authoring Manager was then used to import the QPack and to evaluate how well that had worked.

Website: <http://www.questionmark.com/>

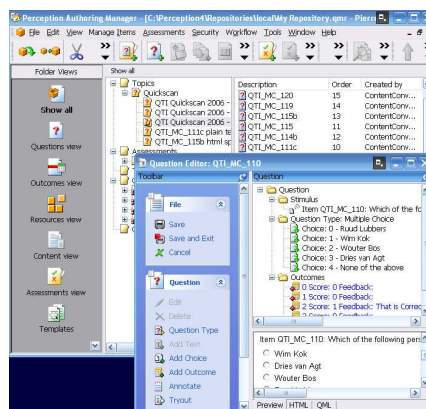


Figure 3 Perception Authoring Manager

3.3.3 N@tschool! 9.0

N@tschool! is a Dutch VLE from the Rotterdam based Threeships Enterprises company. It offers a wide range of functionality like for example a content repository, an assessment centre, a project centre, a digital portfolio and a learning management system⁷. For this quickscan, only the assessment centre has been reviewed. Within the centre test items, sections and assessments can be created. They can be displayed on the screen or exported to Word documents. N@tschool! has its own support for import and export of QTI files.

Website: <http://www.natschool.com/> (Dutch)

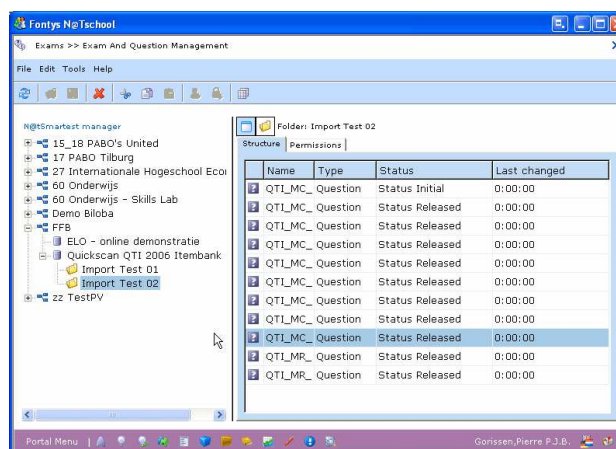


Figure 4 N@tschool!

⁷ Though it is a Dutch product, the interface language can be set to English on a per user basis.

3.3.4 Blackboard 6.3.1.5.74

Market leader in the VLE arena in the Netherlands, like it was in 2003, is Blackboard. For this quickscan the version 6.3.1.5.74 has been tested. Blackboard offers no direct QTI import options for a teacher/course developer. Just like for the quickscan in 2003, Respondus has been used to test the import into Blackboard. Blackboard has an assessment manager and a question pool.

Website: <http://www.blackboard.com/>

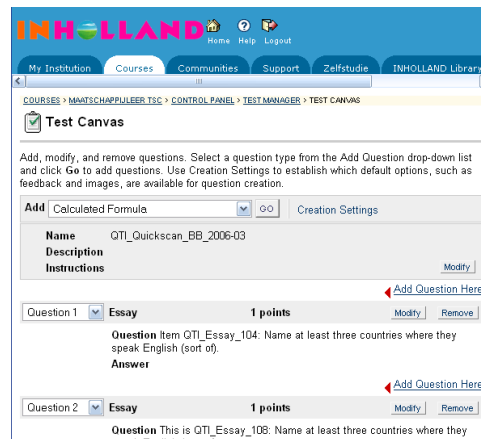


Figure 5 Blackboard 6.0

3.3.5 Learn eXact 3.0.33.4

Learn eXact, developed by Giunti Interactive Labs is a Learning Content Management System (LCMS). The system consists of a couple of main components: the eXact Packager, the eXact Siter, and the eXact Lobster. During this quickscan the eXact Packager has been tested. The Question Database of the Packager, which handles the import of the test files, does not support QTI, but QTI-Lite. Because Learn eXact is being used as the central LCMS for *The Digitale Universiteit (DU)*, a special QTI-Lite set was created and used both for the 2003 and 2006 versions of this quickscan.

Website: <http://www.learnexact.com/>

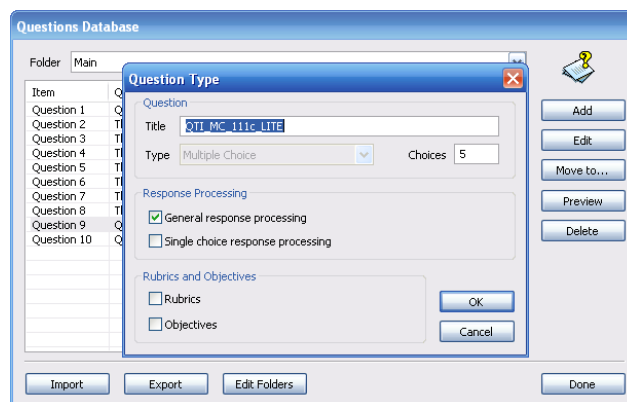


Figure 6 Learn eXact Packager

3.3.6 TOIA

TOIA is an online assessment management system available free of charge to all UK further and higher education institutions. It offers a hosted service and the software can be downloaded and installed on the institutions own servers. TOIA aims to remove many of the barriers for teachers who wish to move into computer-assisted assessment and wants to avoid lock-in to a particular proprietary system by support for specifications like QTI 1.2 and 2.0. Support for the QTI 2.0 version is currently in beta.

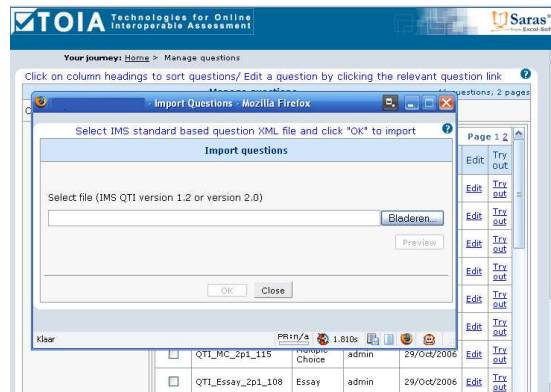


Figure 7 TOIA

3.4 Overview test cycle

Figure 8 shows an overview of the complete test cycle for this quickscan:

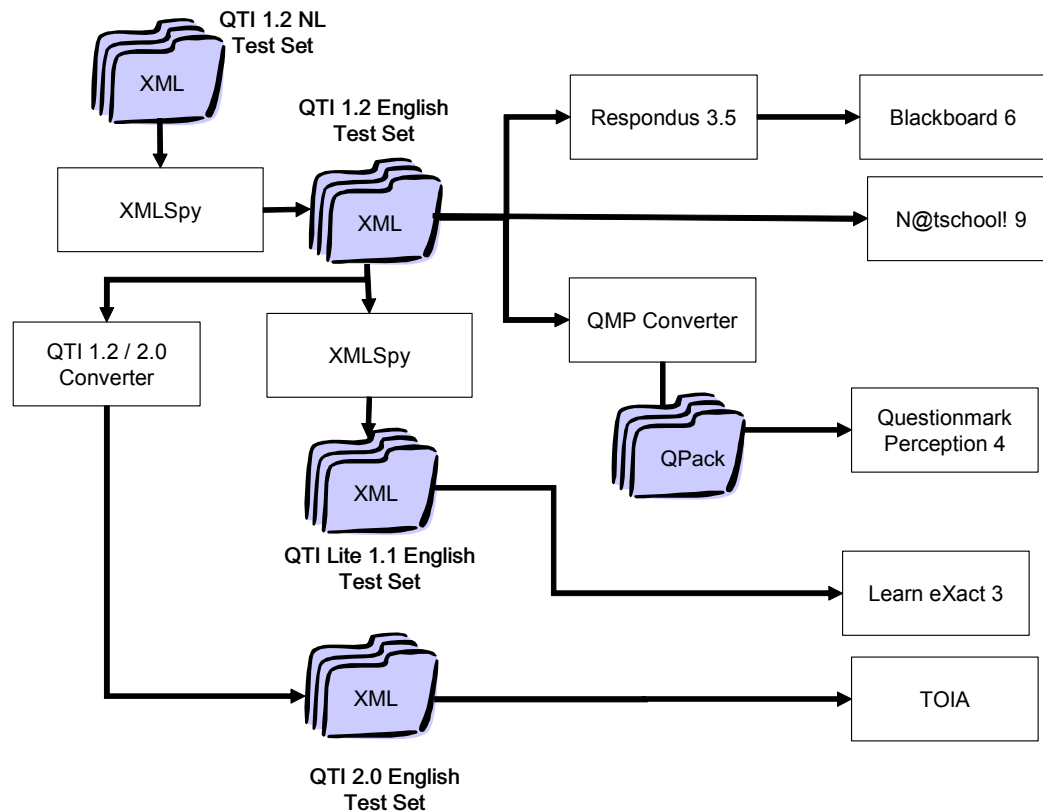


Figure 8 overview test cycle

Base for the current test cycle was the test set as created for the 2003 version of the quickscan. All individual XML files have been translated to English using XMLSpy. From that set a new QTI Lite using the translated items has been created. Using the Python migration tool, the translated item set has been converted to a QTI 2.0 item set. The QTI 1.2 set has been imported into Respondes and from Respondus into Blackboard. The QTI 1.2 set has also been directly tested against N@tschool! 9. For the QuestionMark Perception 4 test, the set of QTI 1.2 items has been converted to a single QPack using the online QMP Converter for QTI 1.2. The QTI-Lite files were imported directly into Learn eXact and the TOIA system has been tested using the QTI 2.0 test set. For all applications, except for the QMP Converter a test form has been filled in stating the results of the test.

The QTI 1.2 and the QTI 2.0 test set can be downloaded as a single zip file from the DU website.



4 Test results

As you can see in Figure 8 on page 19, this time only two of the tested applications, Respondus and N@tschool! use the actual QTI 1.2 test set directly. Blackboard relies on Respondus to do a conversion, QuestionMark Perception uses an online conversion tool, but even though that is provided by QuestionMark itself, it is an extra step compared to the direct import used during the 2003 version of the quickscan. Learn Exact used the QTI LITE set and TOIA was tested using the converted QTI 2.0 set of items. Still the functionalities tested are the same for the different versions of the files. And the results can be compared despite the (small) differences in actions taken to import items or (small) differences in XML formats that were being imported. Annex C on page 29 show a summary of the test results while Annex D, starting on page 32 goes into more detail. In that second annex, it also is explained, where possible, what failed and why in case of a failure to import the file. Because of its dependency on Respondus to import QTI, Blackboard is restricted to the import capabilities of Respondus for its import.

4.1 Respondus 3.5

Like the previously tested 2.0.2 version the 3.5 version of Respondus can import QTI files only within the "QTI 1.1+ personality", not in the Blackboard personality. Imported QTI files can't be added to existing Respondus files, like you can do with plain text import. And because the test set consisted of individual XML files and the transfer to Blackboard is easier with all questions in the same Respondus file, the extra one-by-one import followed by a one-by-one copy/paste action performed during the 2003 test was repeated.

Respondus can import the multiple-choice items, the multiple response items and the essay items. For the fill in the blanks questions there is a restriction of only one FIB element to be used at the end of the question wording.

The use of HTML and/or images is possible in the question wording, the feedback and the answer options. If the item contains images using the QTI <matimage> element, Respondus asks during import for the location of the images.

Where applicable you can use feedback per answer option and general feedback.

Special characters are imported correctly now. See also the side text on this page about that. Respondus doesn't import metadata, learning-objectives, rubrics or hints. There is no support for sections and/or assessments, though the individual items from those files are imported.

Summarizing: no big changes since 2003, better support for special characters and the FIB handling has been corrected.

Special characters like ë and é are often used in Dutch. During the 2003 version of the quickscan Respondus and QuestionMark Perception required that you converted for example ë to ë or ë. This 2006 version of the quickscan showed that all tested application handle both encoded and plain versions of these special characters without a problem both in HTML and in plain text.

Side text 1 Special characters

4.2 QuestionMark Perception 4.1.1.10

The current Perception Authoring Manager, unlike the version 3.4.0.2, requires the QTI items to use a reference to the QTI 1.2 DTD instead of the schema reference used in the test set. The online QuestionMark conversion tool apparently has been build from the ground up and lacks support for a number of items that the 3.4.0.2 version of the Authoring Manager did have support for.

The multiple response questions, the fill in the blank questions and the essay questions, which all had been handled well before, were not available in the QPack file created by the online conversion tool.

Handling of HTML in answer options has been improved and special characters now are imported correctly. See also the side text on this page.

The conversion tool did not import metadata or hints, and unlike last time, the rubric element and the learning-objectives were not available in the Authoring Manager. There is no support for QTI sections and/or assessments, though the individual items from those files are imported.

Summarizing: some improvements since 2003 and a number of import features that are no longer available because they have not been re-implemented yet.



4.3 N@tschool! 9.0

Assessments, sections and questions are being stored in folders within the assessment centre of N@tschool!. The import function is easily available. The import of multiple-choice questions and multiple response questions was successful. There is no support for essay questions or fill in the blank questions. Use of HTML in the question wording and the feedback is possible, but not in the answer options. N@tschool! has only one feedback field and no support for feedback per answer option or separate feedback for incorrect and correct answers. Scores can't be stored as part of the question. In one case (QTI_MC_108b.XML) the complex structure of <respcondition> elements, using one negative score, resulted in the incorrect interpretation of the correct answer option for that question.

Special characters are being imported and displayed without a problem.

Even though N@tschool! has an entry field for tips, the hints in a QTI file aren't being imported. The content of the rubric field, learning-objectives aren't being imported.

N@tschool! can create sections and assessment, but can't import them. When you try to import a file with an assessment or a section, you'll receive a popup saying that the import was successful, even though the individual questions in those files aren't actually imported.

Though N@tschool! has extensive internal support for the use of metadata for assessments, sections and items, the metadata in the QTI files isn't imported.

Summarizing: support for QTI has not changed since last time.

4.4 Blackboard 6.3

Because Respondus is being used to import the QTI files into Blackboard, the remarks made in section 4.1 on page 20 are applicable here also. Questions that can be imported into Respondus can also be imported into Blackboard.

Summarizing: for changes see Respondus.

4.5 Learn eXact 1.7

The quickscan tested Learn eXact Packager in combination with QTI-Lite files instead of the original QTI files set. That also means that the results for Learn eXact like shown in Annex C on page 29 are based on the _LITE version of those files.

Learn eXact still refuses to import questions that don't have response processing (QTI_MC_101_LITE.XML en QTI_MR_102_LITE.XML). The multiple choice and multiple response questions that did have response processing were imported all right. Essay questions and fill in the blank questions aren't part of the QTI Lite specifications and weren't imported by Learn eXact either. Learn eXact now handles HTML code correctly. It is possible to import one image per answer option, the link to that image is stored in a separate media field. Special characters are being imported and displayed without problems. Metadata and hints are being ignored during import, the rubric element and learning-objectives are being imported and available while editing the question. They aren't available for the student though.

Summarizing: Better handling of HTML, no major changes.

4.6 TOIA

The quickscan tested Learn eXact Packager using the converted QTI 2.0 files. That also means that the results for TOIA like shown in Annex C on page 29 are based on the 2p0 version of those files.

TOIA expected the variables FEEDBACK and SCORE to be declared in the item, even if they were not used. That introduced additional requirements not listed in the specification.

As some of the other systems, the TOIA import was scarce in giving feedback about the reason of failure of an import of valid QTI 2.0 items. It did not handle the multiple response and fill in the blanks items and feedback that was part of the item was not always displayed correctly in the editor after an item had been imported and was opened for editing. Use of bold and italic styles in the HTML in the item body resulted in parts of the text not being displayed. Special characters were handled without a problem.

Summarizing: TOIA did not do bad, but not better than the others.



5 Summary of the changes

The next section give an overview of the major changes since the first time the quickscan was performed in 2003.

5.1 Overview of possibilities

5.1.1 Assessments, Sections and Items

Like in 2003, none of the applications in this quickscan has support for assessments or sections, neither in QTI 1.2 or QTI 2.1 format.

5.1.2 More than one item in the same file

Even without the use of a <section> element it was possible to store multiple QTI 1.2 items in the same file. That is useful if you are planning to transport multiple, possibly unrelated, questions from one system to another. N@tschool!, the QuestionMark converter and Learn eXact can import those questions into the same 'folder'. Respondus imports the question into a single Respondus file and can be transferred to Blackboard and WebCT in one go. The QuestionMark converter accepts QTI 1.2 items in a zip file with additional images etc. TOIA has support for zip files with QTI 2.0 items, again with additional resources.

5.1.3 Multiple Choice questions

Use of the elements <flow></flow>, <flow_mat></flow_mat>, <flow_label></flow_label> in QTI 1.2 files is still not advised to enable interoperability with Learn eXact.

5.1.4 Multiple response questions

The QuestionMark converter did not have support for the multiple response QTI 1.2 questions in the test set. All the other systems have at least some kind of support for the multiple response questions in the set.

5.1.5 Essay questions

N@tschool! and Learn eXact still have no support for the import of QTI 1.2 essay questions. The QuestionMark converter does not have support for QTI 1.2 essay questions either. Respondus and Blackboard can handle QTI 1.2 essay questions, TOIA can import QTI 2.0 essay questions.

5.1.6 Fill in the blank

Fill in the blank questions can't be imported by N@tschool! and Learn eXact. Respondus, and because of that Blackboard, can only import fill in the blank questions with one single FIB element. TOIA could not import the converted fill in the blank items in QTI 2.0 format.

5.1.7 True/False questions

Though often looked at as a different question type, True/False questions are basically multiple-choice questions with two answer options: "True" and "False" or "Yes" and "No". Because of that the remarks made for multiple-choice questions apply here also.

5.1.8 HTML

Learn eXact now has support for HTML. N@tschool! has support for HTML in the question wording and the feedback, but not in the answer options. The other applications support HTML in the question wording, the feedback and the answer options for QTI 1.2. TOIA can handle HTML in QTI 2.0 items, but had problems with the particular code used by the test set.

5.1.9 Images

QuestionMark Perception now has better support for images in both the question and the answer options. TOIA can handle images in items and answer options of QTI 2.0 items. N@tschool! cannot handle images in answer options.

5.1.10 Feedback for items

Respondus, WebCT, Blackboard 6, Learn eXact and QuestionMark Perception support feedback per answer option for multiple-choice questions. N@tschool! doesn't have support for feedback per answer option. TOIA has support for modal feedback per answer option in QTI 2.0 files.



5.1.11 Metadata for items

As is 2003, none of the applications in this quickscan has support for metadata for items.

5.1.12 The order of answer options for items

Not change in the support for the requirement to mix fixed and shuffled answer options. See this example:

Which of the following people has not yet been prime minister of the Netherlands?

- A) Wim Kok
- B) Ruud Lubbers
- C) Wouter Bos
- D) Dries van Agt
- E) None of the above

Example 4 Multiple Choice question

Here answer options A – D are to be shown in a random order, while answer op E always should be displayed as the last answer option. This is common practice in the IMS examples and all questions in the test set use it were applicable. But as said, it is unsupported so far. TOIA does not have support for this either.

5.1.13 Response processing

No changes in the handling of response processing.
TOIA does not support more complex response processing than the other systems do.

5.1.14 Rubric for items

Only Learn eXact imported the rubric elements for items. The QuestionMark converted, unlike the authoring tool tested in 2003, does not import them.

5.1.15 Learning-objectives for items

Only Learn eXact imported the learning objectives for items. The QuestionMark converted, unlike the authoring tool tested in 2003, does not import them.



6 Conclusions and recommendations

Given the fact that there is a clear business case for the exchange of assessment items and even assessments and the resulting need for better interoperability one would have expected a significant increase of possibilities since the first quickscan in 2003. Especially since there are no other formats that really compete with QTI, it makes sense for publishers of items to demand support for this format by vendors.

This quickscan however showed no such development for the applications tested then and now. This leads to a number of conclusions and recommendations.

6.1 Conclusions

Based on the results of this and the previous quickscan, a number of conclusions have been formulated:

- The quickscan shows no significant increase in support for QTI by the systems involved in this quickscan. This despite the clear overview of issues that was provided by the 2003 version of the quickscan and the obvious business need for better interoperability.
- The TOIA system did not perform significantly better while importing the QTI 2.0 items when compared with the systems importing QTI 1.2 items.
- The converted test set covered only a small part of the actual QTI 2.1 functionality.
- Systems in general provide poor feedback when trying to import QTI items. This makes 'fixing' items where the import fails almost impossible.

6.2 Recommendations

Based on the quickscan and the conclusions in the previous sections, a number of recommendations can be made:

- The level of support for QTI, or any other interoperability specification that enables the exchange of assessment items has not significantly improved during the last three years. Apparently the market does not yet see the importance of that and their customers fail to explain that need to them. This calls for more explicit actions from funding bodies to require use of tools that assure interoperability of the developed assessment materials.
- Developing good import and export functionality for QTI is not easy and it is a waste of time if each and every vendor has to develop support for that on an individual basis. The educational community would be much better (less expensive) if an open source reference implementation of this functionality is built. This open source implementation enables vendors to look at an example of how to implement the needed functionality so that they can adapt their systems accordingly.

6.3 Future

Despite the results in this quickscan, the recent developments in new systems that were built taking IMS QTI into account suggests that a future update of this quickscan (in 2009?) might paint a different picture.

During the Learning Design Summit in November 2006, a system demonstrating the integration of the IMS Learning Design and the IMS Question and Test Interoperability specifications was demonstrated. The R2Q2 project⁸ created webservices that handle the rendering and response processing for systems. That can lead to a more distributed handling of assessments. That would enable a situation much like a lot of the current Web 2.0 mash-ups where for example one service provides mapping functionality, the other provides a photo storage service and a user mixes those two to show his pictures on a map.

Especially in cases of formative assessment, where security isn't such an most important, and where the items and response processing are probably more complex, that might be a feasible solution.

⁸ See: <http://www.r2q2.ecs.soton.ac.uk/index.htm>

Annex A Content of test set

QTI 1.2 files

QTI 1.2 files...	Plain text or HTML	Type	Rubric	Learning-objectives	Feedback	Score	Metadata	Hints	Solution	Images	Description
Items											
QTI_MC_101.XML	Plain text	Multiple Choice	N	N	N	N	N	N	N	N	Simple multiple-choice question with one correct answer, without response processing.
QTI_MC_101b.XML	Plain text	True/False	N	N	N	N	N	N	N	N	A multiple choice question with two response choices (True/False or in this case Yes/No) and one correct answer. The question has response processing and feedback.
QTI_MR_102.XML	Plain text	Multiple response	N	N	N	N	N	N	N	N	Simple multiple response question with the correct answer consisting of multiple responses. No response processing present.
QTI_MR_102b.XML	Plain text	Multiple response	N	N	Y	Y	N	N	N	N	Based on QTI_MR_102 with added response processing, feedback and score.
QTI_Essay_104.XML	Plain text	Essay	N	N	N	N	N	N	N	N	Simple essay question.
QTI_FIB_105.XML	Plain text	Fill in the blank	N	N	N	N	N	N	N	N	Fill in the blank question with two render_fib elements
QTI_FIB_105b.XML	Plain text	Fill in the blank	N	N	N	N	N	N	N	N	Fill in the blank question with one render_fib element. Based on QTI_FIB_105.
QTI_FIB_105c.XML	Plain text	Fill in the blank	N	N	Y	Y	N	N	N	N	Based on QTI_FIB_105 with some modifications: only one render_fib element, added response processing and feedback.
QTI_MC_107.XML	Plain text	Multiple Choice	N	N	Y	Y	N	Y	N	N	Based on QTI_MC_101 with addition of hints
QTI_MC_108.XML	Plain text	Multiple Choice	N	N	Y	Y	N	N	Y	N	Multiple-choice question with the use of the 'solution' element.
QTI_MC_108b.XML	Plain text	Multiple Choice	N	N	Y	Y	N	N	Y	N	The correct answer is stored in the 'solution' element, this correct answer is also used for the feedback for incorrect choices. The correct answer is worth 2 point, answer options C is worth -1 point!
QTI_Essay_108.XML	Plain text	Essay	N	N	N	N	N	N	Y	N	Based on QTI_Essay_104 with worked out example for the essay question.
QTI_MC_109.XML	Plain text	Multiple Choice	N	N	Y	N	N	N	N	N	Added feedback for each individual answer option.
QTI_MC_110.XML	Plain text	Multiple Choice	N	N	Y	Y	N	N	N	N	
QTI_MC_111.XML	Plain text	Multiple Choice	N	N	Y	N	N	N	N	N	Based on QTI_MC_101 with these modifications: feedback for incorrect answer added. No score processing.



QTI 1.2 files...	Plain text or HTML	Type	Rubric	Learning-objectives	Feedback	Score	Metadata	Hints	Solution	Images	Description
QTI_MC_111b.XML	Plain text	Multiple Choice	N	N	Y	Y	N	N	N	N	Based on QTI_MC_111, added feedback for correct answer and score processing.
QTI_MC_111c.XML (new in 2006 version)	Plain text	Multiple Choice	N	N	Y	Y	N	N	N	N	Based on QTI_MC_111c, added special characters both encoded and unencoded.
QTI_MC_114.XML	HTML	Multiple Choice	N	N	N	N	N	N	N	N	Based on QTI_MC_101 with added HTML code
QTI_MC_114b.XML	HTML	Multiple Choice	Y	Y	Y	Y	N	N	N	Y	Based on QTI_MC_115, added learning-objectives and rubric
QTI_MC_115.XML	HTML	Multiple Choice	N	N	Y	Y	N	N	N	Y	Based on QTI_MC_114, added more complex HTML code (image in answer), processing of users choice (score, feedback) from QTI_MC_108 has been added, processing of incorrect choice from QTI_MC_111 has been added.
QTI_MC_115b.XML (new in 2006 version)	HTML	Multiple Choice	N	N	Y	Y	N	N	N	Y	Based on QTI_MC_115, added special characters both encoded and unencoded.
QTI_MC_119.XML	Plain text	Multiple Choice	N	N	N	N	Y	N	N	N	
QTI_MC_120.XML	Plain text	Multiple Choice	N	Y	Y	Y	N	N	N	N	Based on QTI_MC_111b, added learning-objectives
QTI_MC_121.XML	Plain text	Multiple Choice	Y	N	Y	Y	N	N	N	N	Based on QTI_MC_111b, added rubric.
Sections											
QTI_S_MC_201.XML	Plain text	Section	N	N	N	N	N	N	N	N	Simple section with two multiple-choice questions.
QTI_S_MC_202.XML	Plain text	Section	N	Y	N	N	N	N	N	N	Based on QTI_S_MC_201, added section learning-objectives.
QTI_S_MC_203.XML	Plain text	Section	Y	N	N	N	N	N	N	N	Based on QTI_S_MC_204, added rubric for section.
QTI_S_MC_204.XML	Plain text	Section	N	N	N	N	N	N	N	N	Based on QTI_S_MC_201, added text for section.
Assessment											
QTI_A_MC_301.XML	Plain text	Assessment	N	N	N	N	N	N	N	N	Simple assessment with one section with two multiple-choice questions.

**QTI LITE 1.1 files**

For the test of Learn eXact as many as possible of the original QTI files were converted to QTI-Lite. For some, for example for the essay questions, that wasn't possible since that question type isn't supported by QTI-Lite. The converted files have been added to the test set, the filename of the converted files are the same as the original names with the suffix "_LITE" added.

This resulted in the following set of QTI-Lite files:

QTI_MC_101_LITE.XML	QTI_MC_101b_LITE.XML
QTI_MR_102_LITE.XML	QTI_MR_102b_LITE.XML
QTI_MC_108_LITE.XML	QTI_MC_108b_LITE.XML
QTI_MC_109_LITE.XML	QTI_MC_110_LITE.XML
QTI_MC_111_LITE.XML	QTI_MC_111b_LITE.XML
QTI_MC_114_LITE.XML	QTI_MC_114b_LITE.XML
QTI_MC_115_LITE.XML	QTI_MC_120_LITE.XML
QTI_MC_121_LITE.XML	QTI_S_MC_201_LITE.XML

Annex B Profile of QTI 2.1 Test Set

[illegible]

Annex C Summary of the test results

	Functionality	QTI file... (1.2 / LITE / 2.1)	Respondus 3.5	QuestionMark Perception 4.1	N@tschool! 9.0	Blackboard 6.3	Learn eXact 3.0	TOIA	
1	Items								
1.01	multiple choice question (one question option)	QTI_MC_101.XML	Yes	No*	Yes	Yes	No	Yes	
		QTI_MC_110.XML	Yes	Yes	Yes	Yes	Yes	No	
		QTI_MC_101b.XML	Yes	Yes	Yes	Yes	Yes	No	
1.02	use of multiple response questions	QTI_MR_102.XML	Yes	No*	Yes	Yes	No	No	
		QTI_MR_102b.XML	Yes	No*	Yes	Yes	Yes	No	
1.04	use of essay questions	QTI_Essay_104.XML	Yes	No*	No	Yes	No	Yes	
		QTI_Essay_108.XML	Partial	No*	No	Partial	No	Yes	
1.05	use of fill in the blank questions	QTI_FIB_105.XML	No	No*	No	No	No	No	
		QTI_FIB_105b.XML	Partial	Partial*	No	Partial*	No	No	
		QTI_FIB_105c.XML	Partial	Partial*	No	Partial*	No	No	
1.07	use of hints in a question	QTI_MC_107.XML	No	No	Partial	No	No	No	
1.08	showing the correct answer for a question	QTI_MC_108.XML	Partial	Partial	Partial	Partial	Partial	No	
		QTI_Essay_108.XML	No	No	No	No	No	Yes	
		QTI_MC_109.XML	Yes	Yes	No	Yes	Yes	Yes	
		QTI_MC_115.XML	No	Partial*	Partial	Partial*	No	No	
1.09	being able to have different feedback for each possible answer option	QTI_MC_109.XML	Yes	Yes	No	Yes	Yes	Yes	
1.10	being able to have feedback for correct answers	QTI_MC_110.XML	Yes	Yes	No	Yes*	No	No	
		QTI_MC_109.XML	Yes	Yes	No	Yes*	Yes	Yes	
		QTI_MC_115.XML	Yes	No*	No	Yes*	No	No	
1.11	being able to have feedback for incorrect answers	QTI_MC_111.XML	No	No	No	No	No	No	
		QTI_MC_111b.XML	No	No	No	No	No	No	
		QTI_MC_109.XML	Yes	Yes	No	Yes*	Yes	Yes	
		QTI_MC_115.XML	No	No	No	No	No	No	
1.12	being able to assign different scores to each answer option	QTI_MC_108.XML	Yes	Yes	No	Yes	Yes	Yes	
		QTI_MC_108b.XML	Partial	Yes	No	No*	No	Partial	
		QTI_MC_109.XML	Yes	Yes	No	Yes	Yes	Yes	
		QTI_MC_110.XML	Yes	Yes	No	Yes	Yes	No	
		QTI_MC_111b.XML	Yes	Yes	No	Yes	Yes	No	
1.13	the use of plain text in a question of the feedback	QTI_MC_115.XML	Yes	Yes	No	Yes	Yes	No	
		QTI_XX_XXX.XML	Yes*	Partial	Yes	Partial	Yes	Yes	
1.14	the use of HTML code text for a question and/or the feedback	QTI_MC_114.XML	Yes	No*	Partial	Yes	No	No	
		QTI_MC_114b.XML	Yes	Yes*	Partial	Yes	No	Partial	
1.15	the use of images in a question and/or the feedback	QTI_MC_115.XML	Yes	Yes*	No	Yes	Yes	Partial	
		QTI_MC_114b.XML	Yes	Yes*	No	Yes	No	Partial	
1.19	the use of metadata for an item	QTI_MC_119.XML	No	No	No	No	No	No	



	Functionality	QTI file... (1.2 / LITE / 2.1)	Respondus 3.5	QuestionMark Perception 4.1	N@tschool! 9.0	Blackboard 6.3	Learn eXact 3.0	TOIA	
1.20	being able to store the learning-objective of an item	QTI_MC_120.XML	No	No*	No	No	Yes	No	
		QTI_MC_114b.XML	No	No*	No	No	Yes	No	
1.21	being able to store the rubric for an item	QTI_MC_121.XML	No	No*	No	No	Yes	No	
		QTI_MC_114b.XML	No	No*	No	No	Yes	No	
1.22	being able to have the answer options displayed in random order	QTI_MC_101.XML	No	No*	Partial	No	No	No	
2.	Sections								
2.01	use of sections	QTI_S_MC_201.XML	Partial	Partial	No	No	No	No	
2.02	being able to store learning-objectives for a section	QTI_S_MC_202.XML	No	No	No	No	No	No	
2.03	being able to store the rubric for a section	QTI_S_MC_203.XML	No	No	No	No	No	No	
2.04	being able to store text for a section	QTI_S_MC_204.XML	No	No	No	No	No	No	
		QTI_S_MC_203.XML	No	No	No	No	No	No	
2.05	being able to calculate a score for a section	-	No	No	No	No	No	No	
2.06	being able to give feedback based on the calculated score for a section	-	No	No	No	No	No	No	
2.07	being able to store metadata for a section	-	No	No	No	No	No	No	
2.08	the ability to display the questions in a random order	-	No	No	No	No	No	No	
2.09	the ability to display a question based on the answer for a previous question	-	No	No	No	No	No	No	
3.	Assessments								
3.1	being able to exchange assessments	QTI_A_MC_301.XML	Partial	Partial	No	No	No	No	
3.2	being able to store learning-objectives for an assessment	-	No	No	No	No	No	No	
3.3	being able to store the rubric for an assessment	-	No	No	No	No	No	No	
3.4	being able to store text etc. that is relevant for the complete assessment	-	No	No	No	No	No	No	



	Functionality	QTI file... (1.2 / LITE / 2.1)	Respondus 3.5	QuestionMark Perception 4.1	N@tschool! 9.0	Blackboard 6.3	Learn eXact 3.0	TOIA	
3.5	being able to calculate a total score for the assessment	-	No	No	No	No	No	No	
3.6	being able to give feedback for the assessment based on the calculated total score	-	No	No	No	No	No	No	
3.7	being able to store metadata for the assessment	-	No	No	No	No	No	No	
3.8	being able to have sections and/or items in an assessment displayed in random order	-	No	No	No	No	No	No	
3.9	the ability to display a question based on the answer for a previous question	-	No	No	No	No	No	No	

Annex D Detailed test results

Respondus 3.5

The test results for Respondus determine to great extend the results for the Blackboard test because Respondus is being used for the import there.

Test results Respondus 3.5

	Functionality	QTI file...	Import?	Comments
1	Items			
1.01	use of multiple choice questions (one answer option)	QTI_MC_101.XML	Yes	Note: Respondus assumes that each question has a correct answer. For QTI_MC_101.XML that information isn't present in the file. Respondus chooses the first answer option as the correct one, even when that isn't the case.
		QTI_MC_110.XML	Yes	
		QTI_MC_101b.XML	Yes	
		QTI_MC_XXX.XML	N/A	For the results of all XXX files, see their specific test results.
1.02	use of multiple response questions	QTI_MR_102.XML	Yes	After modifying the question in Respondus, you have to enter the score. The fact that that info isn't in the QTI file isn't a problem here (unlike with the MC question).
		QTI_MR_102b.XML	Yes	Though no feedback.
1.03	use of drag and drop questions	-	-	
1.04	use of essay questions	QTI_Essay_104.XML	Yes	
		QTI_Essay_108.XML	Partial	The solution element wasn't imported.
1.05	use of fill in the blank questions	QTI_FIB_105.XML	No	Though Respondus can handle "fill in the blank" questions, it wasn't able to import this file.
		QTI_FIB_105b.XML	Partial	Respondus imported the question, all the text is there but the FIB element is not in the right location.
		QTI_FIB_105c.XML	Partial	Respondus imported the question, all the text is there but the FIB element is not in the right location.
1.06	use of hot spot questions	-	-	
1.07	use of hints in a question	QTI_MC_107.XML	No	The information is no longer available after the import.

Test results Respondus 3.5

	Functionality	QTI file...	Import?	Comments
1.08	showing the correct answer for a question	QTI_MC_108.XML	Partial	The contents of the <solution> element wasn't imported. But correct answer was.
		QTI_Essay_108.XML	No	The worked out example wasn't imported.
		QTI_MC_109.XML	Yes	All answer options have feedback.
		QTI_MC_115.XML	No	The contents of the <solution> element wasn't imported, instead the feedback for the incorrect answer was imported as 'general feedback'.
1.09	being able to have different feedback for each possible answer option	QTI_MC_109.XML	Yes	This is the way Respondus works.
1.10	being able to have feedback for correct answers	QTI_MC_110.XML	Yes	The feedback is imported as answer option specific feedback for the correct answer.
		QTI_MC_109.XML	Yes	All answer options have feedback.
		QTI_MC_115.XML	Yes	The feedback is imported as answer option specific feedback for the correct answer.
1.11	being able to have feedback for incorrect answers	QTI_MC_111.XML	No	Depending on the choice during import, the feedback for the incorrect answer was either #1 stored for both correct and incorrect answers or #2 ignored completely.
		QTI_MC_111b.XML	No	Same as QTI_MC_111.XML
		QTI_MC_109.XML	Yes	Same as QTI_MC_111.XML
		QTI_MC_115.XML	No	Same as QTI_MC_111.XML
1.12	being able to assign different scores to each answer option	QTI_MC_108.XML	Yes	
		QTI_MC_108b.XML	Partial	In Respondus only the score for the correct answer is imported and not the (negative) score for the incorrect answer.
		QTI_MC_109.XML	Yes	
		QTI_MC_110.XML	Yes	
		QTI_MC_111b.XML	Yes	
		QTI_MC_115.XML	Yes	
1.13	the use of plain text for a question and/or the feedback	QTI_XX_XXX.XML	Yes	Special characters work ok even if not encoded in both plain text and HTML.
		QTI_MC_111c.XML		
		QTI_MC_115b.XML		
1.14	the use of HTML code text for a question and/or the feedback	QTI_MC_114.XML	Yes	If you want to edit the question, Respondus indicates that it contains complex HTML code.
		QTI_MC_114b.XML	Yes	

Test results Respondus 3.5

	Functionality	QTI file...	Import?	Comments
1.15	the use of images in a question and/or the feedback	QTI_MC_115.XML	Yes	During import of the questions Respondus asks for the folder containing the images used.
		QTI_MC_114b.XML	Yes	Note, because the <solution> element wasn't imported, the image used in there wasn't displayed naturally.
1.16	the use of video in a question and/or the feedback	-	-	
1.17	the use of audio in a question and/or the feedback	-	-	
1.18	the use of other objects (for example Flash) in a question and/or the feedback	-	-	
1.19	the use of metadata for an item	QTI_MC_119.XML	No	
1.20	being able to store the learning-objective of an item	QTI_MC_120.XML	No	
		QTI_MC_114b.XML	No	
1.21	being able to store the rubric for an item	QTI_MC_121.XML	No	
		QTI_MC_114b.XML	No	
1.22	being able to have the answer options displayed in random order	QTI_MC_101.XML	No	Order is fixed to the order in the QTI files.
		QTI_MC_XXX.XML	No	
2.	Sections			
2.01	use of sections	QTI_S_MC_201.XML	Partial	Respondus imports the items out of the section, all other section specific information is lost. As a result of that the answers to all following questions are also 'No'
2.02	being able to store learning-objectives for a section	QTI_S_MC_202.XML	No	
2.03	being able to store the rubric for a section	QTI_S_MC_203.XML	No	
2.04	being able to store text for a section	QTI_S_MC_204.XML	No	
		QTI_S_MC_203.XML	No	
2.05	being able to calculate a score for a section	-	No	
2.06	being able to give feedback based on the calculated score for a section	-	No	
2.07	being able to store metadata for a section	-	No	
2.08	the ability to display the questions in a random order	-	No	
2.09	the ability to display a question based on the answer for a previous question.	-	No	



Test results Respondus 3.5

	Functionality	QTI file...	Import?	Comments
3.	Assessments			
3.1	being able to exchange assessments	QTI_A_MC_301.XML	Partial	Respondus imports the items out of the sections in the assessment, all other section specific and assessment specific information is lost. As a result of that the answers to all following questions are also 'No'
3.2	being able to store learning-objectives for an assessment	-	No	
3.3	being able to store the rubric for an assessment	-	No	
3.4	being able to store text etc. that is relevant for the complete assessment	-	No	
3.5	being able to calculate a total score for the assessment	-	No	
3.6	being able to give feedback for the assessment based on the calculated total score	-	No	
3.7	being able to store metadata for the assessment	-	No	
3.8	being able to have sections and/or items in an assessment displayed in random order	-	No	
3.9	the ability to display a question based on the answer for a previous question	-	No	

QuestionMark Perception 4.1.1.10

The following table contains the detailed test results for QuestionMark Perception Authoring Manager 4.1.1.10 after the QTI items had been converted to Qpack files using the online QuestionMark conversion tool. The current Perception Authoring Manager, unlike the version 3.4.0.2, requires the QTI items to use a reference to the QTI 1.2 DTD instead of the schema reference used in the test set.

Test results QuestionMark Perception 4.1.1.10

	Functionality	QTI file...	Import ?	Comments
1	Items			
1.01	use of multiple choice questions (one answer option)	QTI_MC_101.XML	No*	Not in Qpack.
		QTI_MC_110.XML	Yes	
		QTI_MC_101b.XML	Yes	
		QTI_MC_XXX.XML	N/A	For the results of all XXX files, see their specific test results.
1.02	use of multiple response questions	QTI_MR_102.XML	No*	Not in Qpack.
		QTI_MR_102b.XML	No*	Not in Qpack.
1.03	use of drag and drop questions	-	-	
1.04	use of essay questions	QTI_Essay_104.XML	No*	Not in Qpack.
		QTI_Essay_108.XML	No*	Not in Qpack.
1.05	use of fill in the blank questions	QTI_FIB_105.XML	No*	Not in Qpack.
		QTI_FIB_105b.XML	Partial*	First part of sentence is ignored.
		QTI_FIB_105c.XML	Partial*	First part of sentence is ignored.
1.06	use of hot spot questions	-	-	
1.07	use of hints in a question	QTI_MC_107.XML	No	Not in Qpack.
1.08	showing the correct answer for a question	QTI_MC_108.XML	Partial	The <solution> element is being ignored, as feedback the feedback for the correct answer is being used.
		QTI_Essay_108.XML	No	Not in Qpack.
		QTI_MC_109.XML	Yes	QMP supports feedback per answer option.
		QTI_MC_115.XML	Partial*	Images in answer options now display ok.
1.09	being able to have different feedback for each possible answer option	QTI_MC_109.XML	Yes	QMP supports feedback per answer option.
1.10	being able to have feedback for correct answers	QTI_MC_110.XML	Yes	
		QTI_MC_109.XML	Yes	QMP supports feedback per answer option.
		QTI_MC_115.XML	No*	Feedback not correct.
1.11	being able to have feedback for incorrect answers	QTI_MC_111.XML	No	The correct answer gives the feedback for incorrect.
		QTI_MC_111b.XML	No	The correct answer gives the feedback for incorrect.
		QTI_MC_109.XML	Yes	QMP supports feedback per answer option.
		QTI_MC_115.XML	No	Feedback is incorrect.
1.12	being able to assign different scores to each answer option	QTI_MC_108.XML	Yes	
		QTI_MC_108b.XML	Yes	Even the negative score is imported.

Test results QuestionMark Perception 4.1.1.10

	Functionality	QTI file...	Import ?	Comments
		QTI_MC_109.XML	Yes	
		QTI_MC_110.XML	Yes	
		QTI_MC_111b.XML	Yes	
		QTI_MC_115.XML	Yes	Even though the question use useless because the HTML isn't displayed.
1.13	the use of plain text for a question and/or the feedback	QTI_XX_XXX.XML	Partial	Special characters work ok even if not encoded in both plain text and HTML.
		QTI_MC_111c.XML		
		QTI_MC_115b.XML		
1.14	the use of HTML code text for a question and/or the feedback	QTI_MC_111c.XML	No*	Not in Qpack
		QTI_MC_115b.XML	Yes*	
1.15	the use of images in a question and/or the feedback	QTI_MC_115.XML	Yes*	
		QTI_MC_114b.XML	Yes*	
1.16	the use of video in a question and/or the feedback	-	-	
1.17	the use of audio in a question and/or the feedback	-	-	
1.18	the use of other objects (for example Flash) in a question and/or the feedback	-	-	
1.19	the use of metadata for an item	QTI_MC_119.XML	No	
1.20	being able to store the learning-objective of an item	QTI_MC_120.XML	No*	
		QTI_MC_114b.XML	No*	
1.21	being able to store the rubric for an item	QTI_MC_121.XML	No*	
		QTI_MC_114b.XML	No*	
1.22	being able to have the answer options displayed in random order	QTI_MC_101.XML	No*	Not in Qpack
		QTI_MC_XXX.XML	Partial	
2.	Sections			
2.01	use of sections	QTI_S_MC_201.XML	Partial	The items out of the section are being imported, all other section specific information is lost. As a result of that the answers to all following questions are also 'No'.
2.02	being able to store learning-objectives for a section	QTI_S_MC_202.XML	No	
2.03	being able to store the rubric for a section	QTI_S_MC_203.XML	No	
2.04	being able to store text for a section	QTI_S_MC_204.XML	No	
		QTI_S_MC_203.XML	No	
2.05	being able to calculate a score for a section	-	No	
2.06	being able to give feedback based on the calculated score for a section	-	No	
2.07	being able to store metadata for a section	-	No	
2.08	the ability to display the questions in a random order	-	No	
2.09	the ability to display a question based on the answer for a previous question	-	No	
3.	Assessments			
3.1	being able to exchange assessments	QTI_A_MC_301.XML	Partial	The items out of the assessment are being imported, all other section



Test results QuestionMark Perception 4.1.1.10

	Functionality	QTI file...	Import ?	Comments
				and assessment specific information is lost. As a result of that the answers to all following questions are also 'No'.
3.2	being able to store learning-objectives for an assessment	-	No	
3.3	being able to store the rubric for an assessment	-	No	
3.4	being able to store text etc. that is relevant for the complete assessment	-	No	
3.5	being able to calculate a total score for the assessment	-	No	
3.6	being able to give feedback for the assessment based on the calculated total score	-	No	
3.7	being able to store metadata for the assessment	-	No	
3.8	being able to have sections and/or items in an assessment displayed in random order	-	No	
3.9	the ability to display a question based on the answer for a previous question	-	No	

N@tschool! 9.0

Test results N@tschool! 9.0 Summer Edition + Accelerator Pack

	Functionality	QTI file...	Import ?	Comments
1	Items			
1.01	use of multiple choice questions (one answer option)	QTI_MC_101.XML	Yes	No 'correct' answer is being selected (which is good).
		QTI_MC_110.XML	Yes	
		QTI_MC_101b.XML	Yes	
		QTI_MC_XXX.XML	N/A	For the results of all XXX files, see their specific test results.
1.02	use of multiple response questions	QTI_MR_102.XML	Yes	
		QTI_MR_102b.XML	Yes	
1.03	use of drag and drop questions	-	-	
1.04	use of essay questions	QTI_Essay_104.XML	No	No support for this question type in NS
		QTI_Essay_108.XML	No	No support for this question type in NS
1.05	use of fill in the blank questions	QTI_FIB_105.XML	No	Import failed
		QTI_FIB_105b.XML	No	Import failed
		QTI_FIB_105c.XML	No	Import failed
1.06	use of hot spot questions	-	-	
1.07	use of hints in a question	QTI_MC_107.XML	Partial	The hint is imported as feedback.
1.08	showing the correct answer for a question	QTI_MC_108.XML	Partial	The <solution> element isn't imported. As feedback, the feedback for the correct answer is being used.
		QTI_Essay_108.XML	No	No support for import of essay questions.
		QTI_MC_109.XML	No	NS doesn't support feedback per answer option. In this case the chosen feedback is the feedback of the first answer option.
		QTI_MC_115.XML	Partial	The <solution> element isn't being used. In the feedback, the feedback for the correct answer is being used.
1.09	being able to have different feedback for each possible answer option	QTI_MC_109.XML	No	NS doesn't support feedback per answer option.
1.10	being able to have feedback for correct answers	QTI_MC_110.XML	No	NS doesn't support feedback per answer option.
		QTI_MC_109.XML	No	NS doesn't support feedback per answer option.
		QTI_MC_115.XML	No	NS doesn't support feedback per answer option.
1.11	being able to have feedback for incorrect answers	QTI_MC_111.XML	No	NS doesn't support feedback per answer option.
		QTI_MC_111b.XML	No	NS doesn't support feedback per answer option.

Test results N@tschool! 9.0 Summer Edition + Accelerator Pack

	Functionality	QTI file...	Import ?	Comments
		QTI_MC_109.XML	No	NS doesn't support feedback per answer option.
		QTI_MC_115.XML	No	NS doesn't support feedback per answer option.
1.12	being able to assign different scores to each answer option	QTI_MC_108.XML	No	NS doesn't store scores for items.
		QTI_MC_108b.XML	No	The combination of positive and negative scores causes NS to select the incorrect answer option as the correct option!
		QTI_MC_109.XML	No	
		QTI_MC_110.XML	No	
		QTI_MC_111b.XML	No	
		QTI_MC_115.XML	No	
1.13	the use of plain text for a question and/or the feedback	QTI_XX_XXX.XML	Yes	Special characters work ok even if not encoded in both plain text and HTML.
		QTI_MC_111c.XML		
		QTI_MC_115b.XML		
1.14	the use of HTML code text for a question and/or the feedback	QTI_MC_114.XML	Partial	For QTI import, only in the question wording and the feedback, not in the answer options.
		QTI_MC_114b.XML	Partial	Not in the answer options.
1.15	the use of images in a question and/or the feedback	QTI_MC_115.XML	No	This question only had images in the answer options. NS doesn't support that.
		QTI_MC_114b.XML	No	This question only had images in the answer options. NS doesn't support that.
1.16	the use of video in a question and/or the feedback	-	-	
1.17	the use of audio in a question and/or the feedback	-	-	
1.18	the use of other objects (for example Flash) in a question and/or the feedback	-	-	
1.19	the use of metadata for an item	QTI_MC_119.XML	No	
1.20	being able to store the learning-objective of an item	QTI_MC_120.XML	No	No support for this question type in NS
		QTI_MC_114b.XML	No	No support for this question type in NS
1.21	being able to store the rubric for an item	QTI_MC_121.XML	No	No support for this question type in NS
		QTI_MC_114b.XML	No	No support for this question type in NS
1.22	being able to have the answer options displayed in random order	QTI_MC_101.XML	Partial	Either all fixed or all random, not like in the file.
		QTI_MC_XXX.XML	Partial	Either all fixed or all random, not like in the file.
2.	Sections			
2.01	use of sections	QTI_S_MC_201.XML	No	Despite the 'import successful' message, no items were imported. As a result all other answers for sections are 'No'
2.02	being able to store learning-	QTI_S_MC_202.XML	No	


Test results N@schoo! 9.0 Summer Edition + Accelerator Pack

	Functionality	QTI file...	Import ?	Comments
	objectives for a section			
2.03	being able to store the rubric for a section	QTI_S_MC_203.XML	No	
2.04	being able to store text for a section	QTI_S_MC_204.XML	No	
		QTI_S_MC_203.XML	No	
2.05	being able to calculate a score for a section	-	No	
2.06	being able to give feedback based on the calculated score for a section	-	No	
2.07	being able to store metadata for a section	-	No	
2.08	the ability to display the questions in a random order	-	No	
2.09	the ability to display a question based on the answer for a previous question	-	No	
3.	Assessments			
3.1	being able to exchange assessments	QTI_A_MC_301.XML	No	Despite the 'import successful' message, no items were imported. As a result all other answers for assessments are 'No'
3.2	being able to store learning-objectives for an assessment	-	No	
3.3	being able to store the rubric for an assessment	-	No	
3.4	being able to store text etc. that is relevant for the complete assessment	-	No	
3.5	being able to calculate a total score for the assessment	-	No	
3.6	being able to give feedback for the assessment based on the calculated total score	-	No	
3.7	being able to store metadata for the assessment	-	No	
3.8	being able to have sections and/or items in an assessment displayed in random order	-	No	
3.9	the ability to display a question based on the answer for a previous question	-	No	



Blackboard 6.3.1.574

This table gives an overview of the test results for Blackboard 6.3.1.574.

Because Respondus 3.5 is being used to import the questions into Blackboard, the results for that test to great extent determine the results for this Blackboard test.

Test results Blackboard 6.3.1.574

	Functionality	QTI file...	Import ?	Comments
1	Items			
1.01	use of multiple choice questions (one answer option)	QTI_MC_101.XML	Yes	Because Respondus incorrectly assumes there always is a correct answer, even if that information isn't present in the QTI file, that possibly incorrect information is also transferred into Blackboard.
		QTI_MC_110.XML	Yes	
		QTI_MC_101b.XML	Yes	
		QTI_MC_XXX.XML	N/A	For the results of all XXX files, see their specific test results.
1.02	use of multiple response questions	QTI_MR_102.XML	Yes	
		QTI_MR_102b.XML	Yes	
1.03	use of drag and drop questions	-	-	
1.04	use of essay questions	QTI_Essay_104.XML	Yes	
		QTI_Essay_108.XML	Partial	The worked out example wasn't imported by Respondus and thus wasn't available in Blackboard.
1.05	use of fill in the blank questions	QTI_FIB_105.XML	No	No support in Respondus for this file.
		QTI_FIB_105b.XML	Partial*	All the text is there but the FIB element is not in the right location.
		QTI_FIB_105c.XML	Partial*	All the text is there but the FIB element is not in the right location.
1.06	use of hot spot questions	-	-	
1.07	use of hints in a question	QTI_MC_107.XML	No	No support in Respondus for hints.
1.08	showing the correct answer for a question	QTI_MC_108.XML	Partial	Since Respondus didn't import the contents of the <solution> element, it wasn't available in BB either.
		QTI_Essay_108.XML	No	The worked out example wasn't imported by Respondus and thus wasn't available in Blackboard.
		QTI_MC_109.XML	Yes	Respondus can import feedback per answer option. BB 6 also supports that.

Test results Blackboard 6.3.1.574

	Functionality	QTI file...	Import ?	Comments
		QTI_MC_115.XML	Partial*	The contents of the <solution> element wasn't imported, instead the feedback for the correct answer was used as the feedback for the correct response
1.09	being able to have different feedback for each possible answer option	QTI_MC_109.XML	Yes (6.0)	Supported since BB 6.0.
1.10	being able to have feedback for correct answers	QTI_MC_110.XML	Yes*	
		QTI_MC_109.XML	Yes*	
		QTI_MC_115.XML	No	
1.11	being able to have feedback for incorrect answers	QTI_MC_111.XML	No	Both "incorrect feedback" and "correct feedback" have the same text (which is the one for incorrect answers)
		QTI_MC_111b.XML	No	Only for the correct answer
		QTI_MC_109.XML	Yes*	Feedback available for all options
		QTI_MC_115.XML	No	
1.12	being able to assign different scores to each answer option	QTI_MC_108.XML	Yes	
		QTI_MC_108b.XML	No*	BB supports only one single score for the correct answer for a question. The negative score is ignored.
		QTI_MC_109.XML	Yes	Because it was 0/1
		QTI_MC_110.XML	Yes	Because it was 0/1
		QTI_MC_111b.XML	Yes	Because it was 0/1
		QTI_MC_115.XML	Yes	Because it was 0/1
1.13	the use of plain text for a question and/or the feedback.	QTI_XX_XXX.XML	Partial	Special characters work ok even if not encoded in both plain text and HTML.
		QTI_MC_111c.XML		
		QTI_MC_115b.XML		
1.14	the use of HTML code text for a question and/or the feedback	QTI_MC_114.XML	Yes	
		QTI_MC_114b.XML	Yes	
1.15	the use of images in a question and/or the feedback	QTI_MC_115.XML	Yes	Respondus uploads the images to BB and changes the links to the correct location in BB.
		QTI_MC_114b.XML	Yes	Note: because the <solution> element isn't imported, the image in that element of course isn't displayed either.
1.16	the use of video in a question and/or the feedback	-	-	
1.17	the use of audio in a question and/or the feedback	-	-	
1.18	the use of other objects (for example Flash) in a question and/or the feedback	-	-	
1.19	the use of metadata for an item	QTI_MC_119.XML	No	
1.20	being able to store the learning-objective of an item	QTI_MC_120.XML	No	Not supported by Respondus
		QTI_MC_114b.XML	No	Not supported by Respondus
1.21	being able to store the rubric for an item	QTI_MC_121.XML	No	Not supported by Respondus

Test results Blackboard 6.3.1.574

	Functionality	QTI file...	Import ?	Comments
		QTI_MC_114b.XML	No	Not supported by Respondus
1.22	being able to have the answer options displayed in random order	QTI_MC_101.XML	No	Order Respondus is fixed, identical to the order in the QTI file.
		QTI_MC_XXX.XML	No	
2.	Sections			
2.01	use of sections	QTI_S_MC_201.XML	No	Respondus doesn't support import of QTI sections. Section specific information is lost, only the items are being imported. Because of that the answer to the following section related questions is 'No' also.
2.02	being able to store learning-objectives for a section	QTI_S_MC_202.XML	No	
2.03	being able to store the rubric for a section	QTI_S_MC_203.XML	No	
2.04	being able to store text for a section	QTI_S_MC_204.XML	No	
		QTI_S_MC_203.XML	No	
2.05	being able to calculate a score for a section	-	No	
2.06	being able to give feedback based on the calculated score for a section	-	No	
2.07	being able to store metadata for a section	-	No	
2.08	the ability to display the questions in a random order	-	No	
2.09	the ability to display a question based on the answer for a previous question	-	No	
3.	Assessments			
3.1	being able to exchange assessments	QTI_A_MC_301.XML	No	Respondus doesn't support import of QTI assessments or sections. Assessment and Section specific information is lost, only the items are being imported. Because of that the answer to the following assessment related questions is 'No' also.
3.2	being able to store learning-objectives for an assessment	-	No	
3.3	being able to store the rubric for an assessment	-	No	
3.4	being able to store text etc. that is relevant for the complete assessment	-	No	
3.5	being able to calculate a total score for the assessment	-	No	
3.6	being able to give feedback for the assessment based on the calculated total score	-	No	
3.7	being able to store metadata for the assessment	-	No	



Test results Blackboard 6.3.1.574

	Functionality	QTI file...	Import ?	Comments
3.8	being able to have sections and/or items in an assessment displayed in random order	-	No	
3.9	the ability to display a question based on the answer for a previous question	-	No	

Learn eXact 3.0.33.4

This table contains the results for the tests using Learn eXact 3.0.33.4

Learn eXact doesn't support QTI, but QTI-LITE. That caused problems with all the files of the existing test set. because QTI-LITE doesn't support the <flow>, <flow_mat>, <flow_label> elements which were being used in all the files. The test has been conducted with the converted "_LITE" versions of the files.

Test results Learn eXact 3.0.33.4

	Functionality	QTI file...	Import ?	Comments
1	Items			
1.01	use of multiple choice questions (one answer option)	QTI_MC_101_LITE.XML	No	Because there was no <reprocessing> element Learn eXact refused to import the file (Warning: The item "QTI_MC_101_LITE" cannot be imported because it doesn't contain any Reprocessing)
		QTI_MC_110_LITE.XML	Yes	
		QTI_MC_101b_LITE.XML	Yes	
1.02	use of multiple response questions	QTI_MR_102_LITE.XML	No	Because there was no <reprocessing> element
		QTI_MR_102b_LITE.XML	Yes	
1.03	use of drag and drop questions	-	-	
1.04	use of essay questions	-	No	Not supported by QTI-LITE, no internal support.
1.05	use of fill in the blank questions	-	No	Not supported by QTI-LITE, no internal support.
1.06	use of hot spot questions	-	-	
1.07	use of hints in a question	-	No	Not supported by QTI-LITE, no internal support.
1.08	showing the correct answer for a question	QTI_MC_108_LITE.XML	Partial	The <solution> element was not imported
		QTI_MC_109_LITE.XML	Yes	Each answer option has feedback.
		QTI_MC_115_LITE.XML	No	The content of the <solution> element was not imported. Instead the feedback for the incorrect answer is being used as feedback for 'Correct Response Feedback'.
1.09	being able to have different feedback for each possible answer option	QTI_MC_109_LITE.XML	Yes	
1.10	being able to have feedback for correct answers	QTI_MC_110_LITE.XML	Yes	
		QTI_MC_109_LITE.XML	Yes	All answer options have feedback.

Test results Learn eXact 3.0.33.4

	Functionality	QTI file...	Import ?	Comments
		QTI_MC_115_LITE.XML	No	The content of the <solution> element was not imported. Instead the feedback for the incorrect answer is being used as feedback for 'Correct Response Feedback'.
1.11	being able to have feedback for incorrect answers	QTI_MC_111_LITE.XML	No	The feedback for the incorrect answer is being used as feedback for 'Correct Response Feedback'.
		QTI_MC_111b_LITE.XML	No	The feedback for the incorrect answer is being used as feedback for 'Correct Response Feedback' and vice versa.
		QTI_MC_109_LITE.XML	Yes	All answer options have feedback.
		QTI_MC_115_LITE.XML	No	The feedback for the incorrect answer is being used as feedback for 'Correct Response Feedback' and vice versa.
1.12	being able to assign different scores to each answer option	QTI_MC_108_LITE.XML	No*	
		QTI_MC_108b_LITE.XML	No	Neither of the scores was imported.
		QTI_MC_109_LITE.XML	Yes	
		QTI_MC_110_LITE.XML	No*	
		QTI_MC_111b_LITE.XML	No*	
1.13	the use of plain text for a question and/or the feedback	QTI_XX_XXX_LITE.XML	Yes	Even special characters like "ë", "è" are being imported correctly.
		QTI_MC_111c_LITE.XML		
		QTI_MC_115b_LITE.XML		
1.14	the use of HTML code text for a question and/or the feedback	QTI_MC_114_LITE.XML	No	Import not possible because of lacking <reprocessing>
		QTI_MC_114b_LITE.XML	Partial	The HTML code is imported, but not rendered.
1.15	the use of images in a question and/or the feedback	QTI_MC_115_LITE.XML	Yes	
		QTI_MC_114b_LITE.XML	No	The HTML code is not rendered correctly, only three of the four images is being displayed.
1.16	the use of video in a question and/or the feedback	-	-	
1.17	the use of audio in a question and/or the feedback	-	-	
1.18	the use of other objects (for example Flash) in a question and/or the feedback	-	-	
1.19	the use of metadata for an item	QTI_MC_119_LITE.XML	No	
1.20	being able to store the learning-objective of an item	QTI_MC_120_LITE.XML	Yes	
		QTI_MC_114b_LITE.XML	Yes	
1.21	being able to store the rubric for an item	QTI_MC_121_LITE.XML	Yes	
		QTI_MC_114b_LITE.XML	Yes	
1.22	being able to have the answer options displayed in random	QTI_MC_101_LITE.XML	No	Because of lacking <reprocessing> element .



Test results Learn eXact 3.0.33.4

	Functionality	QTI file...	Import ?	Comments
	order	QTI_MC_XXX_LITE.XML	No	Order is fixed, same as in QTI file.
2.	Sections			
2.01	use of sections	QTI_S_MC_201_LITE.XML	No	Individual items aren't imported either. As a result of this the answer to all following questions is 'No'.
2.02	being able to store learning-objectives for a section	-	No	
2.03	being able to store the rubric for a section	-	No	
2.04	being able to store text for a section	-	No	
2.05	being able to calculate a score for a section	-	No	
2.06	being able to give feedback based on the calculated score for a section	-	No	
2.07	being able to store metadata for a section	-	No	
2.08	the ability to display the questions in a random order	-	No	
2.09	the ability to display a question based on the answer for a previous question	-	No	
3.	Assessments			
3.1	being able to exchange assessments	QTI_A_MC_301.XML	No	Individual items aren't imported either. As a result of this the answer to all following questions is 'No'.
3.2	being able to store learning-objectives for an assessment	-	No	
3.3	being able to store the rubric for an assessment	-	No	
3.4	being able to store text etc. that is relevant for the complete assessment	-	No	
3.5	being able to calculate a total score for the assessment	-	No	
3.6	being able to give feedback for the assessment based on the calculated total score	-	No	
3.7	being able to store metadata for the assessment	-	No	
3.8	being able to have sections and/or items in an assessment displayed in random order	-	No	
3.9	the ability to display a question based on the answer for a previous question	-	No	



TOIA

The test results for the TOIA system are based on the converted test sets. The files in the converted test set are in QTI 2.1 format.

Test results TOIA

	Functionality	QTI file...	Import?	Comments
1	Items			
1.01	use of multiple choice questions (one answer option)	QTI_2p1_MC_101.XML	Yes	
		QTI_2p1_MC_110.XML	No	
		QTI_2p1_MC_101b.XML	No	
		QTI_2p1_MC_XXX.XML	N/A	For the results of all XXX files, see their specific test results.
1.02	use of multiple response questions	QTI_2p1_MR_102.XML	No	
		QTI_2p1_MR_102b.XML	No	
1.03	use of drag and drop questions	-	-	
1.04	use of essay questions	QTI_2p1_Essay_104.XML	Yes	
		QTI_2p1_Essay_108.XML	Yes	
1.05	use of fill in the blank questions	QTI_2p1_FIB_105.XML	No	
		QTI_2p1_FIB_105b.XML	No	
		QTI_2p1_FIB_105c.XML	No	
1.06	use of hot spot questions	-	-	
1.07	use of hints in a question	QTI_2p1_MC_107.XML	No	Couldn't import this item
1.08	showing the correct answer for a question			
		QTI_2p1_MC_108.XML	No	Couldn't import this item
		QTI_2p1_Essay_108.XML	Yes	
		QTI_2p1_MC_109.XML	Yes	All answer options have feedback.
1.09	being able to have different feedback for each possible answer option	QTI_2p1_MC_115.XML	No	Feedback is imported incorrectly
		QTI_2p1_MC_109.XML	Yes	
1.10	being able to have feedback for correct answers	QTI_2p1_MC_110.XML	No	Couldn't import this item
		QTI_2p1_MC_109.XML	Yes	All answer options have feedback.
		QTI_2p1_MC_115.XML	No	Feedback is imported incorrectly
1.11	being able to have feedback for incorrect answers	QTI_2p1_MC_111.XML	No	
		QTI_2p1_MC_111b.XML	No	
		QTI_2p1_MC_109.XML	Yes	
		QTI_2p1_MC_115.XML	No	Feedback is imported incorrectly
1.12	being able to assign different scores to each answer option	QTI_2p1_MC_108.XML	Yes	
		QTI_2p1_MC_108b.XML	Partial	
		QTI_2p1_MC_109.XML	Yes	
		QTI_2p1_MC_110.XML	No	Couldn't import this item
		QTI_2p1_MC_111b.XML	No	Feedback is imported incorrectly
		QTI_2p1_MC_115.XML	No	Feedback is imported incorrectly
1.13	the use of plain text for a question and/or the feedback	QTI_2p1_XX_XXX.XML	Yes	Special characters work ok even if not encoded in both
		QTI_2p1_MC_111c.XML		



Test results TOIA

	Functionality	QTI file...	Import?	Comments
		QTI_2p1_MC_115b.XML		plain text and HTML.
1.14	the use of HTML code text for a question and/or the feedback	QTI_2p1_MC_114.XML	No	Couldn't import this item
		QTI_2p1_MC_114b.XML	Partial	The HTML is displayed incorrectly both during editing in the system and during tryout.
1.15	the use of images in a question and/or the feedback	QTI_2p1_MC_115.XML	Partial	The HTML and images are displayed incorrectly both during editing in the system and during tryout.
		QTI_2p1_MC_114b.XML	Partial	The HTML and images are displayed incorrectly both during editing in the system and during tryout.
1.16	the use of video in a question and/or the feedback	-	-	
1.17	the use of audio in a question and/or the feedback	-	-	
1.18	the use of other objects (for example Flash) in a question and/or the feedback	-	-	
1.19	the use of metadata for an item	QTI_2p1_MC_119.XML	No	Could not import item
1.20	being able to store the learning-objective of an item	QTI_2p1_MC_120.XML	No	
		QTI_2p1_MC_114b.XML	No	
1.21	being able to store the rubric for an item	QTI_2p1_MC_121.XML	No	
		QTI_2p1_MC_114b.XML	No	
1.22	being able to have the answer options displayed in random order	QTI_2p1_MC_101.XML	No	Either all fixed or all random.
		QTI_2p1_MC_XXX.XML	No	
2.	Sections			
2.01	use of sections	-	-	TOIA supports QTI 2.0 and doesn't support sections.
2.02	being able to store learning-objectives for a section	-	-	
2.03	being able to store the rubric for a section	-	-	
2.04	being able to store text for a section	-	-	
2.05	being able to calculate a score for a section	-	-	
2.06	being able to give feedback based on the calculated score for a section	-	-	
2.07	being able to store metadata for a section	-	-	
2.08	the ability to display the questions in a random order	-	-	
2.09	the ability to display a question based on the answer for a previous question.	-	-	
3.	Assessments			



Test results TOIA

	Functionality	QTI file...	Import?	Comments
3.1	being able to exchange assessments	-	-	TOIA supports QTI 2.0 and thus doesn't support assessments.
3.2	being able to store learning-objectives for an assessment	-	-	
3.3	being able to store the rubric for an assessment	-	-	
3.4	being able to store text etc. that is relevant for the complete assessment	-	-	
3.5	being able to calculate a total score for the assessment	-	-	
3.6	being able to give feedback for the assessment based on the calculated total score	-	-	
3.7	being able to store metadata for the assessment	-	-	
3.8	being able to have sections and/or items in an assessment displayed in random order	-	-	
3.9	the ability to display a question based on the answer for a previous question	-	-	



Quickscan QTI
Usability study of QTI for The Digitale Universiteit (DU)