

EVALUATING THE ACCESSIBILITY TO DISABLED PEOPLE OF E- ASSESSMENT TOOLS

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Abstract

E-assessment tools offer enormous potential for educational organisations to support disabled students in a flexible, accessible way, while also helping to meet legal obligations to avoid undue discrimination. However, tools need to support authors in creating assessments without introducing accessibility barriers. Information on the extent to which e-assessment tools support accessible assessment authoring is scarce; and where information does exist, this tends to be focused on the accessibility of the output, rather than the quality of the authoring process. An accessibility evaluation methodology was developed and used by the authors to review a popular e-assessment tool. The review identified a number of accessibility issues with the software interface and output. It also found issues that might limit the ability of authors to create optimally accessible assessments, meaning a modified approach to training and support is required, as well as improvements to the assessment tool. Organisations evaluating e-assessment tools for accessibility therefore need to seriously consider how effective these tools are in supporting accessible authoring, rather than limiting attention to the accessibility of the output of the tool.

Introduction

In the UK, education institutions have obligations under the Disability Discrimination Act (DDA 1995 and DDA 2005) to proactively consider the needs of disabled students and staff when developing learning, teaching and assessment resources. E-assessments, and tools for their creation, have enormous potential to help meet these obligations through enhancing the accessibility of the learning environment to students with disabilities. They can

also support staff of all technical abilities in efficiently producing quality assessments; and so the use of web-based learning and assessment is attractive to academics operating in an environment in which student numbers are steadily increasing while staff resources are falling (Hodson et al. 2002).

Previous research has pointed to potential benefits for disabled students through use of e-assessment - for example, evidence has emerged indicating that dyslexic students find e-assessment less stressful than paper-based methods due to the lesser significance of spelling and punctuation in e-assessment tasks (Ricketts and Wilks, 2002). Compared to paper versions, electronic assessments also offer the potential for visually impaired students to customise the display of assessments to suit their accessibility requirements, while those with more severe impairments can access the same assessment in audio (through a screen reader) or tactile (through a Braille display) formats. Flexibility in data input supports people for whom a physical disability would make written tests difficult or impossible.

The presentation of assessments online has implications for the cognitive demands placed on students; on-screen reading times; navigation through assessment content; use of multimedia and inclusion of graphical question types (Sim et al. 2004). More fundamentally, authors of assessments may inadvertently introduce accessibility barriers through inappropriate assessment design. The desire to achieve efficiencies through automatic marking and the potential for question and/or assessment reusability can offset accessibility considerations which may be viewed as an investment without promise of returns. Specific issues have previously been identified relating to the use of free text response and 'jumbled sentence' question types within e-assessments, with students found to be critical of the limited flexibility of answer acceptance and additional problems encountered when using screen readers (Smith, 2008). Accessibility considerations are therefore often implemented as reactive measures to identified student needs rather than as proactive measures, and even then awareness of accessible design techniques cannot be assumed amongst users of e-assessment tools.

Developments in support for accessible Web authoring

Support for accessible web content authoring has grown in recent years as economic, technical and social arguments for Web accessibility, plus legal obligations in many countries, have significantly raised awareness of the issue. The World Wide Web Consortium (W3C) Web Accessibility Initiative (WAI) published Version 1.0 of the Web Content Accessibility Guidelines (WCAG) in 1999. Since then, many resources, from printed literature to web-based tutorials to software tools have emerged to support the creation of accessible web content. The subject of accessibility and learning technology is also an area of increasingly active research and development (Seale, 2006; Dunn, 2003).

WAI recognises that the responsibility for an accessible Web lies not just with the web author, but with two additional stakeholder groups, each of whom have been provided with complementary sets of guidelines (Chisholm and Henry, 2005):

- For manufacturers and providers of **web browsing technology**, including assistive technology for disabled web users, the User Agent Accessibility Guidelines (UAAG) (W3C 2002).
- For manufacturers and providers of **web content authoring tools**, from full software applications to web based interfaces enabling content publication, the Authoring Tool Accessibility Guidelines (ATAG) (W3C 2000).

Thus, for a truly accessible Web, WCAG-conformant content should be created using ATAG-conformant authoring tools, and accessed by UAAG-conformant web browsing technology.

ATAG sets out the requirements that should be met by any tool that enables web content publication – including e-assessment tools – in order that the material produced is as accessible as possible. ATAG is particularly concerned with the ease with which accessible authoring can be achieved by non-experts. Key requirements of ATAG include:

- The tool should integrate accessible authoring practices throughout its functionality, without requiring authors to go through additional, optional steps in order to create accessible content.
- Facilities should be provided to ensure that equivalent accessible alternatives for images and multimedia content are specified when such content is added.
- The tool should support authors in checking for accessibility problems before content is published.
- HTML code generated automatically by the tool should validate to formal HTML standards.
- The authoring interface should be optimally accessible, including people with visual and mobility impairments.

Meeting all checkpoints of ATAG help the final indicator of conformance – that content generated by the tool should conform to W3C WCAG.

Unfortunately the tripartite approach to accessibility of W3C has a number of practical weaknesses (Kelly et al 2005), one of which is the scarcity of available authoring tools that meet ATAG. The impact of this general lack of ATAG-conformance is serious when considering the increasing opportunities available to people to publish web content without requiring extensive skills in HTML and other technologies. The opening up of the Web as a publishing medium has been made possible through, for example, virtual learning environments (VLEs), e-assessment software, and e-portfolios, and through 'user-generated content' enabled by web applications such as Facebook, Bebo and Youtube. As the number of Web authors grows, so to the proportion of authors who are not dedicated web professionals, or who do not have extensive knowledge of web accessibility, will increase. This places enormous responsibility on web content authoring tools to ensure as far as possible that

authors of all levels of expertise can easily create content that is as accessible as possible.

Context of the Review

Aware of the need to ensure that electronic assessments created by staff at the University of Dundee are as accessible as possible, the authors conducted an accessibility evaluation of the commercial e-assessment authoring tool made available to staff. The review sought to identify:

- The level of accessibility of the tests the tool generates, and
- The level of support given to authors in creating accessible content.

The assessment tool evaluated was Questionmark Perception™ (QMP) version 4.2 (Authoring Manager 4.1.1). The University has an established background in online assessment, with a site licence for QMP and activity occurring across a range of subject disciplines and levels of study. Online assessment practice is governed by the University's dedicated Online Assessment Policy and Procedures (University of Dundee, 2006).

The primary aim of this review was therefore to establish internally the extent to which the tool supported accessible assessment authoring. Any issues that emerged would be assessed to establish whether these could be addressed by suitable advice and training given to authors, technical adjustments to the University's implementation of the software, or whether only the software vendor could take the necessary action.

The primary output of the review was a report identifying conformance with W3C ATAG, highlighting areas of non-conformance and their likely impact on the accessibility of assessments produced. The outcomes of the evaluation would inform developments in the Online Assessment Policy, including advice to authors, advice to those responsible for training and supporting authors, and also any relevant advice to disabled students, where this might help them overcome any unavoidable accessibility issues in tests.

Related work

In considering an evaluation methodology, many published accessibility reviews of web and e-learning content were found (see for example DRC 2004; Thompson et al. 2003; Sloan et al. 2002). These reviews adopted a range of automated and manual evaluation techniques. A combination of these techniques with usability reviews involving disabled evaluators is considered the most effective method of identifying the greatest number of true accessibility barriers, and minimising false positives (that is, barriers that in reality do not affect a disabled person from using the site for the intended task) (Sloan et al. 2002; W3C 2005).

Publicly available accessibility reviews of web authoring tools, by contrast, were found to be much sparser. This appears to reflect the imbalance of attention on accessibility of content over the means by which that content was created, although some accessibility reviews of authoring software may have a commercial sensitivity which may limit their wider availability. One exception is an accessibility review of the WordPress blogging system, using ATAG, by Clark (2006). As well as an interesting insight into the extent to which a popular web authoring tool supports accessible content authoring – the report found several checkpoints that were not met - this publication provides a useful format for presenting results of an ATAG evaluation, along with a critique of ATAG itself.

Techdis, the advisory service on disability, learning and technology to the UK post-16 educational sector, have published some valuable resources in the area of accessible e-assessment¹. The focus of their work has, though, been more generally on the effective use of e-assessment to promote an accessible learning environment, rather than specifically focusing on the accessibility evaluation of assessment systems. Similarly, the ALERT project² also provided guidelines on accessible assessments, but did not provide specific advice on assessing the quality of e-assessment tools in generating accessible output.

Methodology

The methodology used for the review included the following stages:

1. Review of existing literature on accessibility and Questionmark Perception. This included information provided by the software suppliers, and also from other sources, in particular educational institutions that have previously conducted a similar exercise or who have otherwise provided resources addressing the accessibility of the software.
2. Accessibility review of the Questionmark Perception interface – how accessible it is to disabled users, and how well it promotes and prompts the creation of accessible assessments. This involved a series of manual tests of the tool's functionality and interface, using the ATAG checkpoints as a reference.
3. Accessibility review of sample output created by Questionmark Perception. This output was provided by staff at the University's Learning Centre. Manual and automated evaluations of the content output were conducted, including accessing the content using a range of assistive technologies and under a range of browsing conditions.

¹ See http://www.techdis.ac.uk/index.php?p=9_1 for more details

² ALERT project website: <http://www.bournemouth.ac.uk/alert/>

Two versions of a sample assessment - in question-by-question and scrolling formats - were created in advance so that QMP output and the process for accessing and taking a test could be reviewed. Additionally, the authors worked through the question authoring process together, to assess the process for authoring the different question types. Supporting documentation was also reviewed for mention of accessibility.

Due to time limitations, it was not possible to involve disabled evaluators in the review, either as authors or as students accessing the sample output test. While ATAG assessment largely focuses on the functionality of the tool – i.e. the features it offers to support accessible authoring, involvement of disabled evaluators would have provided additional useful information on the accessibility of the tool’s interface and its output.

Findings

The key findings of the review, in terms of ATAG checkpoints found not to have been met, are summarised in **Table 1**.

ATAG Checkpoint not met	Details of findings
2.2 Ensure that the tool automatically generates valid markup.	Assessments generated as HTML pages were not provided with a Document Type Declaration statement, making it impossible to validate the markup.
3.1 Prompt the author to provide equivalent alternative information (e.g., captions, auditory descriptions, and collated text transcripts for video)	Multimedia: no option to specify an equivalent alternative for the multimedia content. Images: the process of adding an image does include space for entering alternative text, but the label (Alternate Text) does not explicitly identify this field as being an accessibility feature, nor its importance, and therefore authors may fail to provide an <i>appropriate</i> text alternative.
3.2 Help the author create structured content and separate information from its presentation. and 4.1 Check for and inform the author of accessibility problems.	Authoring tools should support this by as far as possible automating accessible authoring, and supporting manual checks where this is not possible, but QMP failed these checkpoints on several counts: <ul style="list-style-type: none"> • No options to check for the presence of colour contrast issues between text and background colours, or reliance on colour perception. • No options to specify an assessment as being in a particular language, nor to identify a change in language of particular piece of content. • Accessible data table authoring required direct editing of HTML. • No support for readability and grammar checking –

	features that potentially are of particular use to authors with dyslexia or other specific learning difficulties.
3.3 Ensure that pre-packaged content conforms to the Web Content Accessibility Guidelines 1.0	The drop down boxes created when authoring a Matching question result in an interface that could not be navigated successfully using the keyboard, thus failing WCAG 1.0's requirement for device-independent operation.
3.4 Do not automatically generate equivalent alternatives. Do not reuse previously authored alternatives without author confirmation, except when the function is known with certainty.	ATAG specifically requires that tools do not automatically insert alt="" if the text alternative field for an image is left blank. QMP fails on this because it did insert alt="" for images if the author does not specify an alternative.

Table 1: QMP and areas of non-conformance with ATAG

Accessibility of the QMP interface

Significant difficulties were found in the QMP interface, in particular when attempting to operate the software using the keyboard only. The complex layout combining frames and navigation trees did not support easy keyboard operation, and it appeared that some functionality could not be accessed without a mouse. Similarly, attempting to access and navigate through published assessments using QM Secure was extremely challenging, whereas access in non-secure mode was significantly less problematic.

Problems with keyboard operation will affect any author who cannot use a mouse because of a mobility impairment that affects manual dexterity, and also anyone who has no functional vision. However, more in-depth user testing with disabled authors is required to establish the true extent to which QMP can be used by people with visual and mobility impairments.

Accessibility Documentation for QMP

ATAG Checkpoint 6.1 requires tools to document all features that promote the production of accessible content, and other ATAG checkpoints require that accessible design techniques be fully integrated within tutorials and other user support resources. For QMP, though, the user interface and Help documentation did not list features that actively promote accessible content creation, and the Help section on Authoring Best Practice gives little explicit information on best practice for accessible design. There was no information on accessibility in the QMP Getting Started guide available as a PDF document.

Instead, accessibility information is provided on the QMP web site, but in the Knowledge Base, which requires users to register in order to access this

content, making it difficult to find even for individuals specifically looking for information on accessibility. The nature of this advice focuses on advising authors which features to use and avoid, and recommends using assessment templates, question types and delivery methods that aid accessibility. Specific mention is given to the Access Template, created to avoid accessibility issues present in other templates.

Implications

A number of outstanding issues exist in terms of the support the tool gives authors in avoiding introducing accessibility barriers. In particular, there is a need to better support the provision of accessible alternatives for graphics and multimedia, and integrating accessible authoring practice – including accessibility checks – before publishing content. There is also evidence that the interface itself has accessibility barriers that require to be addressed in order to allow access by disabled authors.

For the University of Dundee, and other institutions using QMP, awareness of these issues requires a short-term strategy for helping authors to avoid introducing accessibility barriers. Staff training and support should therefore emphasise the following key messages:

- When using images and multimedia content as part of question content, provide suitable alternatives for anyone unable to access this content.
- Use the HTML editor to make sure the appropriate structural information is provided for content.
- Use a range of accessibility checking methods to check assessments before they are published.

The issue of the accessibility problems that appear to be inherent in the software interface are altogether more difficult to address. Until accessibility features within the authoring interface are improved, staff affected will have to be supported in creating assessments through alternative routes.

Discussion

In this discussion, the authors wish to make it clear that these observations should not be seen as simply a direct attack on the accessibility deficiencies of QMP. Rather the review identifies examples of issues that we believe are present in the wider authoring tool market, and here we attempt to explain the impact of these issues, suggest reasons for why they exist, and what collective action can be taken to resolve them.

One of the most significant findings, beyond the immediate shortcomings identified during the review, is the perception of how the accessibility qualities of authoring tools should be measured and reported by vendors and by institutions using the tools, and the effect this has on responsibilities of

stakeholders towards ensuring accessibility of whatever the tool outputs. The authors' position, shared by that of W3C, is that responsibility lies not only with the content author, but also the developers of authoring tools and, to a certain extent, end users.

However, it would seem from the scarcity of information on the topic that tool developers and vendors see accessible authoring support to at least some extent as a customer demand – or even a feature request – and therefore place an arguably excessive responsibility on authors to check their own work for accessibility. This position is made clear from the content of a presentation given to the CETIS Accessibility Special Interest Group on Questionmark Perception and accessibility in June 2006³. The presentation indicates that Questionmark sees accessibility as a customer-driven issue; in explaining how features are typically added to a software product, there is an implication that accessibility has become addressed by Questionmark only as and when customers ask for it. The viewpoint emerging from the presentation is that there is confusion over 'competing' accessibility standards, which seems to make it difficult for Questionmark to target accessibility improvements in a way that meets customer demands. Yet, like Questionmark's web site documentation on accessibility, the presentation makes no mention of W3C ATAG.

It is accepted that tool vendors are driven by market demands, and while accessibility should arguably be a core feature of any fit-for-purpose authoring tool, the reality is that vendors will most likely be motivated to address accessibility if their customers demand it⁴. Therefore, this signifies a lack of prominence in ATAG conformance in customer demands for accessibility. Typically, when accessibility of learning technology in the UK is mentioned, the focus is on the educational institution's obligations as an educational provider under the DDA, and ultimately it is the accessibility of the end product that is considered, not the quality of the authoring process. This moves pressure away from the vendors onto organisations and individuals to check output, when a more efficient and effective solution would be for authoring tools to better support the process of accessible content authoring. Only when ATAG conformance becomes a critical factor in selection of learning technologies do we believe that vendor attitudes to accessibility will change.

It would be clearly incorrect to state that accessibility has not been considered in QMP, or that it is significantly worse than other authoring tools in its accessibility support. Efforts have been made to support accessible authoring, particularly through provision of the Access Template and additional advice

³ Accessible e-Assessment: available at <http://zope.cetis.ac.uk/members/accessibility/meetings/2006/sig14/johnhtml>

⁴ Interestingly, in the US, accessibility legislation – Section 508 of the Rehabilitation Act – appears to have influenced technology vendors to improve the accessibility of their products, as this legislation places responsibilities on federal agencies to procure and provide accessible technology. Thus there are financial benefits for vendors to adapt to market demands, shaped by legal obligations placed on the customer. The resulting accessibility improvements are experienced globally, not just in the US.

that recommends authors avoid specific question types and assessment output formats. There may be very valid reasons why accessibility issues have been addressed through the provision of a specific template, rather than adapting the functionality of the tool itself. However, there are drawbacks in this approach, most notably that a user has to be proactive in first becoming aware of, then finding, installing and using the Access Template in order to optimise accessibility of their assessments. It is also apparent from the description of the Access Template that it very much seems to be intended to address relatively minor presentational issues inherent in Perception's core style output.

Much of the advice on accessible QMP authoring also appears to be influenced by the need to avoid using JavaScript. WCAG 1.0 effectively forbade the reliance on scripting languages such as JavaScript as the only way of providing content and functionality. However, recent technical developments in browser and assistive technology support mean that current attitudes to scripting and accessibility have changed. Effectively, scripting is no longer seen as an automatic barrier to accessibility, with the new philosophy - as captured in the in-draft WCAG 2.0 - being "If scripting is used to provide content and functionality, then make sure that content and functionality is as accessible as possible."

Conclusion

The review process discussed in this paper, and the findings of the review will, it is hoped, be informative to other individuals and organisations looking to conduct accessibility assessments of learning technology, and to take appropriate steps to avoid or limit the impact of any accessibility shortcomings found. Longer term, a publicly available pool of accessibility reviews of authoring tools may support organisations faced with selecting a tool that best fits their needs.

Accessible web content creation, whether e-assessments or any other content, cannot be created by automated means alone, and authors must either develop awareness of accessible design, or be supported by the authoring tool. The increase in population of web authors without the time or motivation to develop technical expertise means that authoring tools have an increasingly important role to play in supporting accessible content creation.

Our experience indicates that there is work to do by vendors on raising the level of support for accessible authoring through automated means and manual prompts. This will however require customers to express clearly and collectively their demands for accessibility support. The importance of W3C ATAG as the benchmark against which to measure accessibility of authoring tools such as e-assessment tools – where the focus should be the **process** of authoring accessibly, rather than simply the output – cannot be understated.

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