

Using multimedia to enhance the accessibility of the learning environment for disabled students: reflections from the Skills for Access project

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As educators' awareness of their responsibilities towards ensuring the accessibility of the learning environment to disabled students increases, significant debate surrounds the implications of accessibility requirements on educational multimedia. There would appear to be widespread concern that the fundamental principles of creating accessible web-based materials seem at odds with the creative and innovative use of multimedia to support learning and teaching, as well as concerns over the time and cost of providing accessibility features that can hold back resource development and application. Yet, effective use of multimedia offers a way of enhancing the accessibility of the learning environment for many groups of disabled students. Using the development of 'Skills for Access', a web resource supporting the dual aims of creating optimally accessible multimedia for learning, as an example, the attitudinal, practical and technical challenges facing the effective use of multimedia as an accessibility aid in a learning environment will be explored. Reasons why a holistic approach to accessibility may be the most effective in ensuring that multimedia reaches its full potential in enabling and supporting students in learning, regardless of any disability they may have, will be outlined and discussed.

Introduction

Multimedia in e-learning offers significant potential in enhancing the learning environment, through helping to widen access to education, enhancing the learning experience and supporting multiple learning styles (Thornhill *et al.*, 2002; Littlejohn, 2003). As availability, capability and affordability of technology (hardware and

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software) improves, teachers have increased opportunity to create and use multimedia in curriculum design. For example, video and audio recordings and photographs could be used to capture and convey real-world experiences and events, whether from the past or in real time. Animated interactive diagrams could be used to demonstrate and simulate concepts in many different disciplines, allowing students to study effects over time or as the result of changing specific parameters.

For disabled students, multimedia can offer the potential to significantly improve the accessibility of the learning environment and, indeed, extending the learning environment to otherwise inaccessible places; for example, using video to enhance the accessibility of field-trip environments to students with physical disabilities. At the same time, poorly designed or inappropriate use of multimedia could effectively exclude a disabled student from a learning programme. Given the legal imperatives of the UK's Disability Discrimination Act (DDA) in the United Kingdom (HMSO, 1995), extended in 2001 to cover the provision of post-16 education, and of similar legislation in many countries around the world, educational establishments and their staff have increased responsibility to ensure that unjustified discrimination is not experienced by disabled students.

Consequently, there is significant activity in the e-learning community towards ensuring that accessibility to disabled people is a key consideration in the development of educational online resources (Seale, 2004), particularly those intended for reuse for different purposes in different environments (Brewer & Treviranus, 2003).

Guidelines for the creation of accessible e-learning resources (IMS Global Learning Consortium, 2002) offer accessibility advice in the context of creating resources for learning and teaching. The ongoing IMS AccessForAll work, involving the Accessibility for Learner Information Package Specification (IMS ACCLIP) and AccessForAll Metadata Specification, (both available from the IMS website¹) together provide a framework for storing a learner's specific accessibility preferences and a structured way of describing a resource's specific accessibility characteristics, the degree to which it may be customised to enhance its accessibility while preserving pedagogic aim and any equivalent alternatives.

Making multimedia optimally accessible

The broadcasting sector has for some time been taking steps to address issues relating to accessibility of broadcast television services, to the extent that key accessibility techniques developed in 'traditional' broadcasting have been adapted for multimedia web content (Clark, 2002; Carey, 2005a). In the United Kingdom, the Independent Television Commission (ITC) produced guidance for the provision of accessibility features for broadcast television, and commissioned research exploring issues relating to the accessibility of interactive digital television provision, with a specific focus on the issues faced by older people (Carmichael, 1999). Ofcom, the ITC's regulatory successor from 2003, assumed the role of promoting accessibility in UK broadcasting, and publishes online the ITC guidance on various aspects of access features for television, as well as setting quotas of accessible programming for broadcasters to

meet (Ofcom, undated). Despite this, concerns have been expressed that accessibility has not as yet played a suitably important role in the rollout of digital television services in the United Kingdom (Carmichael *et al.*, 2005).

On the Web, content and e-learning developers concerned about the accessibility of their resources to disabled students can look to the Web Content Accessibility Guidelines (WCAG) (Web Accessibility Initiative [WAI], 1999) for advice and support. The WCAG, produced by the WAI of the World Wide Web Consortium (W3C) are the *de facto* standard for accessibility of web content, providing a solid foundation on which to build a working knowledge of accessible web design techniques. They also offer a framework on which website evaluation methodologies and automated accessibility checking tools can be based, and a reference for policy-makers and benchmarking exercises.

Version 1.0 of the WCAG overwhelmingly concentrates on HTML-delivered content, and only three of the 65 checkpoints appear to refer directly to multimedia. One such checkpoint includes multimedia within a wider list of webpage elements:

Provide a text equivalent for every non-text element [...] This includes: images [...] animations (e.g., animated GIFs), applets and programmatic objects [...] sounds (played with or without user interaction), stand-alone audio files, audio tracks of video, and video. (Checkpoint 1.1)

Two WCAG checkpoints specifically address the use of multimedia:

Until user agents can automatically read aloud the text equivalent of a visual track, provide an auditory description of the important information of the visual track of a multimedia presentation. (Checkpoint 1.3)

For any time-based multimedia presentation (e.g., a movie or animation), synchronize equivalent alternatives (e.g., captions or auditory descriptions of the visual track) with the presentation. (Checkpoint 1.4)

In each checkpoint, the basic premise is that text and/or audio alternatives must be provided for the multimedia content. Expanding on these two WCAG checkpoints listed, the two key accessibility features required for optimally accessible multimedia are (Clark, 2002):

1. Synchronised text captions, providing spoken and key non-spoken sound information in text, for people who are deaf or hearing impaired.
2. Audio descriptions—audio files synchronised with the main soundtrack of the media clip. These allow people who cannot see the clip to understand its content through the provision of spoken descriptions of key visual events that would not be discernible from the main soundtrack alone.

If these features cannot be provided, a more basic requirement is to provide a text transcript of the media clip, in HTML format, clearly linked from the page containing the media clip in question. The disadvantage of this solution is that, by its nature, it is an alternative to the media clip, rather than an integrated, synchronised solution as with captions and audio descriptions.

Synchronised signed translations of spoken content are also a highly desirable accessibility feature, serving the requirements of people whose primary language is a sign language—and who may have extreme difficulty reading on-screen text. This is currently a particularly rare accessibility solution in practice, given the work required to produce and publish a synchronised signed translation. However, ongoing efforts have attempted to develop an automated animated signed translation facility, through an avatar; for example, the VisiCast project (Elliot *et al.*, 2000).

An additional accessibility feature often required is subtitles, a textual translation of the spoken content of the media clip into the language of the viewing population. This accessibility solution caters for a cognitive disability, that of being unable to understand the spoken content despite being able to hear it. Yet, in the United Kingdom and Ireland, the term ‘subtitles’ is widely, but confusingly, used to refer not just to foreign-language translation but also to captions for people unable to hear the soundtrack (see, for example, the list of accessibility solutions in Carey [2005a]).

Other accessibility requirements for multimedia include the need to ensure that operation is keyboard accessible, to allow people who for reasons of visual or mobility impairment have difficulty in using, or are unable to use, a mouse. For video and audio, this includes basic operations of play, pause, stop, fast-forward and rewind, controlling display and audio properties, and enabling or adjusting accessibility features such as captioning and audio description.

Interactive animated content such as Macromedia Flash may present similar problems if its operation requires fine mouse control. For animated content to be optimally accessible to people who cannot see the animation, there is also a need to ensure that the experiences and information provided by the animation are available in audio format, either by exposing the content to allow a screen reader to read it out, or through audio soundtrack(s) provided with the animation (Regan, 2002).

Multimedia as an assistive technology

For many Web users, accessibility problems result not from the absence of an alternative to information requiring a specific sensory capability or level of manual dexterity, but from the inability to process and understand the information presented on screen. Overwhelmingly this problem is due to the presentation, style and content of on-screen text (Seeman, 2002). People with dyslexia, with concentration difficulties, with reduced short-term memory or with other specific learning difficulties may all struggle with textual information. Similarly problems may be encountered for people for whom English is not their first language (Vanderheiden, 2000). For all these groups, arguably the most inaccessible way of presenting information is through a long page of on-screen text. It follows that presenting information in alternative ways—pictures, diagrams, animated diagrams, video clips, audio recordings—is far more effective in conveying information and experiences, and hence supporting comprehension and retention of information. Multimedia thus becomes an accessibility solution, an assistive technology.

However, for multimedia development, the wider potential of multimedia as an enabler, as a way of making information more accessible to certain groups of disabled people, is not immediately obvious from an inspection of the WCAG. The only indication offered of this potential offered is found in WCAG checkpoint 14.2:

Supplement text with graphic or auditory presentations where they will facilitate comprehension of the page.

It would seem reasonable to infer from this checkpoint, however, that the use of multimedia to enhance comprehension of information, experiences or concepts presented as online text is indeed an important step towards accessibility. Slatin and Rush (2002) make this very point in their book *Maximum Accessibility*, noting that:

In some cases, the best way to enhanced accessibility may be to use more media ... used in the right way, multimedia is a critical resource for accessibility!

The key phrase in this quotation is ‘used in the right way’. There is still a need to ensure that every reasonable effort is taken to ensure that the information and, perhaps more significantly, experience provided by the media clip in question is as accessible as possible to as many as possible of the intended audience.

Challenges to the provision of accessible multimedia

Despite the arguments promoting multimedia as a positive contributor to enhancing the accessibility of the e-learning environment, there are many challenges to be overcome before multimedia can reach its potential as an enabler for disabled students.

Attitudinal

The relative prominence of accessible web design requirements for ensuring content can be accessed by people with visual impairments has contributed to the inaccurate perception that all principles of web accessibility can be summarised as ‘provide all information in text format’—a position that may be further distorted to imply that graphics and colour, let alone video, audio and interactive animated media, is prohibited on account of accessibility. The argument that accessible web content is incompatible with visually pleasing, engaging online experiences has been confidently met by assertions that highly accessible sites can indeed maintain a high degree of visually stimulating content (Zeldman, 2003; Petrie *et al.*, 2004). However, the message that multimedia is an important contributor to accessibility for some groups may unfortunately be lost among the more prominent and apparently higher priority demands for multimedia to be provided with accessibility features to overcome sensory impairments.

The WAI classed the aforementioned checkpoint 14.2 on supplementing text with graphics or audio as a Priority Three WCAG checkpoint, the lowest of the three priority levels allocated to each checkpoint. This arguably recognises that the task of

'supplementing text' with multimedia is likely to require a reasonable degree of production skill and resources, beyond the capacity of many web authors who would be most comfortable providing text, and possibly simple graphics. At the same time it may be interpreted as playing down the positive impact on accessibility of the judicious use of multimedia. The result may be at best a failure to acknowledge the role multimedia content can play in enhancing the accessibility of the information or experience provided by a resource. For example, in an accessibility review of the BBCi website (Robertson *et al.*, 2002), no mention was made of the positive accessibility role that the multimedia present on the site could offer. At worst, there could be a rejection or withdrawal of potentially valuable multimedia content that, as well as potentially enhancing the learning environment more generally, offers specific accessibility benefits for other groups, particularly people with specific learning difficulties (Seeman, 2002).

For multimedia producers and designers, this issue may adversely affect their perceptions of accessibility, given that the strongest message is 'provide alternatives' rather than 'use multimedia'. The authors have had personal experience of producers who, when confronted with the issue of accessibility and potentially discriminatory resources, have experienced a range of emotions:

- Defensiveness or hostility, as they perceive that their previously well-regarded work is coming under attack for being discriminatory.
- Embarrassment, as they realise that their work may exclude certain students from accessing it.
- Fear, and helplessness, as they are told that their work must be 'made accessible' or face the consequences of legal action, without necessarily having the skills or support to make the necessary changes within current work schedules and budgets.
- De-motivation, as they perceive that their work is no longer 'legal', as it may be discriminatory, and is therefore no longer of any worth.

While some of these reactions may seem extreme, the adverse impact of designer attitude to accessibility should not be underestimated.

A perception also exists among some developers that, when it comes to multimedia, providing accessibility features may be seen as 'too expensive', with no cost benefit. This is consistent with a more general resistance to arguments against inclusive design, despite examples of commercial success in, for example, vehicle or household object design (Keates & Clarkson, 2004). Carey (2005b) notes that the 'too expensive and not worth it' argument has historically been the case with regard to analogue broadcast media. This perception remains, as pointed out in criticism of recent accessibility guidance issued by Ofcom to UK broadcasters (Carmichael *et al.*, 2005), despite on the one hand the nature of digital media offering vastly improved capacity for bundling accessibility features such as captions, subtitles, audio descriptions and signed translations along with the media clip, and on the other hand in the reusability, and hence increased potential audience, of digital media, whether web-based or broadcast media that can be recorded and reused through personal video recorder technology.

Practical

There are a number of practical issues relating to effective provision of accessible multimedia. Knowledge and awareness of accessibility issues remains relatively low among web and multimedia developers, although the situation has undoubtedly improved in recent years. The time required to implement accessibility features can be significant, and even more so if done retrospectively. At the same time, while general principles of accessible multimedia are widely accepted, there is a lack of solid research-based guidelines in many more specific aspects of accessible multimedia design.

Tasks such as creating caption files for a pre-existing video clip and synchronising them appropriately with the clip, or creating an accurate transcript of a long audio clip, require practical knowledge of the authoring techniques necessary. The more subjective issue of what to include in a caption or audio description file may also make the task more difficult and lengthy than initially realised. Indeed, while guidance such as that provided by Ofcom may exist, the lack of examples of captioned online video and its implications for best practice is emphasised by Clark (2004), who attempted to define best practice on online captioning, but failed to find any training or quality certification programme dedicated to online captioning. Clark notes:

Nearly everyone doing online captioning today is self-taught.

and:

We are aware of no surveys whatsoever of viewer preferences in online captioning.

Given this, Clark then suggests that:

[...] we need to produce a much larger corpus of online captioned video, in order to make solid recommendations for best practices in online captioning.

While evidence-based best practice may be lacking, some encouraging developments have taken place to ease the practical task of improving the accessibility of multimedia content. The development of tools such as the Media Access Generator (MAGpie²) from the US-based National Centre for Accessible Media eases the task of authoring and adding synchronised captions and audio description files to digital video. Improvements to Macromedia's Flash and Shockwave rich media formats, and authoring tools for creating Flash and Shockwave, have offered greater capacity to include accessibility features such as keyboard accessibility and enhanced compatibility with screen reading technology (Regan, 2002). Bennett *et al.* (2003) describe the development of SMIRK, an authoring tool to facilitate accessible presentation creation with the intention of improving the accessibility of a traditional lecturing scenario. Development by the W3C of the Synchronised Multimedia Integration Language (SMIL) specification (W3C, 2005) creates an open standard for associating captions and audio description files and their timing information with a media file.

However, on a more abstract scale is the issue of multimedia as an accessibility aid. This concept is difficult to encapsulate in solid guidelines applicable across a range of scenarios, and therefore a subjective analysis of the textual information or concept

requiring illustration is required, depending on the pedagogic aim of the e-learning resource in question, and its context in the wider learning environment or programme. A desire for rules and checklists is surprisingly prevalent among media developers, illustrated in recent feedback received by the authors after the launch of the Skills for Access website (discussed later). This is unfortunate, given that the most effective approach to providing an effective accessibility solution is to consider the pedagogic aim of the multimedia object and the resource in which it will appear, and the role of the learning object within a wider context, and using this contextual information to guide the most appropriate approach to optimising accessibility.

Establishing responsibility for accessibility

There is also an issue raised by the situation whereby responsibility for ensuring educational multimedia is optimally accessible may not lie with the agency best placed to provide the accessibility features. While it may be common for teachers to develop their own web-based teaching resources using tools provided by a Virtual Learning Environment or web authoring tool, much multimedia used in e-learning resources is professionally produced, either commissioned through institutions' own production units or external agencies. The increasing interest in reusable learning objects again highlights the situation where the creator of a resource may not be the direct user. The most appropriate and effective place to author and combine accessibility features is at the point of production, but the provision of accessibility features is not commonly considered a standard part of media production, and may require a specific request at the time of commissioning. Some multimedia used in an educational context may be captured or generated live—for example, to facilitate synchronous communication between remote peers or learners and teachers. Provision of live accessibility features such as captions may in such situations prove extremely challenging, especially as human and technical resources are likely to be limited. A significant, and increasing, amount of digital video and audio material is also made available for 'off-the-shelf' educational use; for example, in the United Kingdom, through services such as the Educational Media Online service hosted by EDINA³ and the British Universities Film and Video Council.⁴ It is not clear how much of this digital video content has been provided with captions and audio descriptions, but an optimistic estimate is likely to be an extremely small percentage.

Thus, while the production stage is the most appropriate stage for providing accessibility features, much of the material made available for use by e-learning developers and users may not in fact have the necessary accessibility features, and the providers may be unwilling or unable to provide such features, given the amount of material that would need to be addressed. Yet the legal position is complex, at least with respect to the UK's DDA (Sloan, 2004), when the relationship between the media producer, the organisation providing access to the media, and the educational establishment is considered. It may only be when the material is used by an educational establishment in a way that is discriminatory to a disabled student that legislative requirements come into play. Thus, unless otherwise specified by the educational

institution, the most immediate legal responsibility appears to fall on the e-learning developer or teacher to avoid discriminatory practice, rather than the organisation(s) producing and/or making available the media resource. A scenario may thus emerge whereby e-learning developers around the country are working independently on providing their own captions for the same uncaptioned video clip obtained from an online digital data archive, although an alternative scenario may be the rejection of potentially valuable multimedia content on account of an absence of accessibility features. The IMS AccessForAll work is potentially of great significance here in that it offers a solid framework for specifying accessibility features and limitations of individual resources, and identifying suitable alternatives where access barriers currently exist; for example, where multimedia has been acquired without captions or audio descriptions.

Technical

Aside from the practical issues of developing expertise in providing accessibility solutions to multimedia, and the time and resources required to develop the features, technical challenges may make more difficult the task of creating optimally accessible multimedia for educational purposes. The availability to developers of the appropriate design and evaluation tools necessary to create optimally accessible material is a critical issue, requiring organisations to consider accessibility from a procurement perspective.

With web-delivered multimedia, there is also the complexity of the accessibility capabilities of multimedia technologies and accessibility support of media players; that is, the software that works with the web browser to play the media file and any accessibility feature provided. The W3C has acknowledged the importance of the media player in ensuring accessibility, along with the web browser, assistive technology and other ‘user agents,’ in developing the User Agent Accessibility Guidelines (WAI, 2002).

Significant improvements in media player and media format accessibility have taken place, motivated by legislation in the United States (the 1998 amendment to Section 508 of the Rehabilitation Act) prohibiting federal organisations from providing or using technology with specific accessibility barriers. Unfortunately, at the time of writing, accessibility issues still exist with each of the main media players used for delivering multimedia online. Media player accessibility issues include limited keyboard accessibility to key functions of the features of the player, particularly when the media player exists as an ‘embedded’ interface within a webpage, instead of acting as a stand-alone player opened through activating a link on the webpage (WebAIM, undated). While embedded media integrates the media clip more seamlessly within a webpage, the limitations of keyboard accessibility mean that people who for reasons of mobility impairment or visual impairment are unable to use a mouse may have extreme difficulty accessing the multimedia content.

Media players also have limitations in terms of their support for the accessibility features described earlier. For example, accessibility features may exist only as

'advanced' features not available in the free version of the player, the ability to turn on and off captions is not available in the free version of QuickTime, while at the time of writing Windows Media Player cannot support audio description files at all. The Flash player, from Macromedia, is the most common means of delivering rich animated content through websites, and is increasingly used as an alternative way of delivering video content without requiring a dedicated media player. Despite the aforementioned improvements, some accessibility issues remain with the Flash player, in terms of its support for screen readers and its keyboard accessibility (Heins & Regan, 2002). The task of providing and making available accessibility features such as captions and audio descriptions is made more difficult through the use of one technology, Flash, to play another, the media clip.

Skills for Access: supporting media developers and producers

In an effort to support developers wishing to create optimally accessible multimedia content for learning, and aware of the challenges that face developers in achieving this goal, the Skills for Access project was funded by the Higher Education Funding Council for England and Department of Employment and Learning Northern Ireland to create a web resource devoted to multimedia, accessibility and learning (Stone *et al.*, 2003). Importantly, the project brought together a professional media and e-learning production unit (the Learning Development and Media Unit (LDMU) at the University of Sheffield, UK) and accessibility and inclusive design experts (the Digital Media Access Group (DMAg) at the University of Dundee, UK). As media and e-learning producers, LDMU not only produced media assets for the resource but, as representatives of the intended audience, were involved in specifying requirements for the resource, and evaluating its appropriateness. The expert advice offered by DMAg was then effectively 'trialled' internally within the project team during the resource development, and practical challenges in following accessibility guidelines were identified and documented as part of the information provided by the resource.

Launched in May 2005, the resulting web site⁵ was designed with accessibility and web standards in mind, and provides advice and support in a number of ways:

- **The Skills for Access approach to accessibility, learning and multimedia.** The dual approach to multimedia accessibility is introduced; that is, teachers and e-learning developers are encouraged to use multimedia wherever possible to enhance the accessibility of the traditional learning environment, but at the same time to make best efforts to ensure the multimedia resource—or more specifically the intended learning outcome of the resource—is as accessible as possible to the target audience.
- **How-to guides.** These are a series of resources focusing on a specific accessibility objective applied to a particular multimedia technology. Each guide outlines the objective, discusses details of techniques for achieving the objective and suggests testing mechanisms for ensuring the objective have been met. Importantly, each How-to guide also provides links to other relevant web resources that give more

information on the issue in hand, or provide examples. Topics covered include captioning and audio description of video, and supporting interaction of animated content with alternative input devices.

- **Articles and case studies.** A number of short articles focusing on the potential of multimedia to enhance accessibility of learning, and teaching, were commissioned from experts in the field of multimedia, learning and accessibility. Case studies are also provided, some focusing on disabled students and staff sharing their experiences in using e-learning and multimedia. Other case studies were supplied by media and e-learning developers; who discuss specific projects relating to creating accessible multimedia. As a demonstration of how multimedia can be used to enhance both the provision of information and the browsing experience, several of the case studies are video based.
- **Supporting resources.** Supporting resources include background information, and links to more detailed resources, on disabilities, multimedia technologies and specific access challenges that might be encountered by a disabled student when accessing a learning programme. Also provided are details of the Skills for Access website construction, discussing the features of the site and how it supports accessibility.

Areas of further development of the site include publishing new case studies, with the aim of building up a catalogue of experiences that can be used to inform the community through sharing success stories and frustrations alike.

Developing accessible multimedia for learning: lessons from Skills for Access

Many lessons were learnt along the way during the project. As knowledge of the issues, including legislative requirements, grew among the production team, attitudes of media producers to accessibility became more favourable. Another revelation was the complexity of the current situation of media players and support for accessibility features, and the implications of the work required to implement accessibility solutions. Despite the best efforts to provide information that supported users while encouraging them to think more widely about the issues, some initial feedback has indicated that there is still a preference for short checklist-style information, even though this may lead to inappropriate solutions being chosen.

Those involved in the project also experienced first hand the benefit of considering accessibility from the beginning of the production process, and maintaining this influence throughout. The unavoidable additional time required to implement accessibility solutions, and the need to consider this in scheduling and resourcing projects, was also made clear. This was reflected in LDMU staff feedback and by quotes from two separate case studies published on the Skills for Access website:

It seems to us, therefore, that the pivotal question that runs through the whole implementation of accessible multimedia issue is time. Where do you find the time to do it all? (Case study: providing captioned video clips for the Skills for Access website⁶)

The major factor in achieving (the aims of the captioning exercise) was that of time. The initial transcription of the 7.5 minute video took around 30 minutes. This time could be dramatically reduced if even a rough transcript had been available—which emphasises the point that accessibility requirements should be taken into account at the planning stages (in this case, before filming) rather than subsequently ‘retro-fitting’ an inaccessible resource. (Case study: captioning with QuickTime SMIL, Patrick Lauke⁷)

It is clear that, for multimedia production, the task of ‘retrofitting’ existing work to be made optimally accessible is particularly challenging. At the same time, it is easy for developers to apply accessibility solutions inappropriately, creating solutions that may appear to be technically ‘accessible’, but to fail to provide disabled people with the equivalent intended learning experience, or solutions that dilute the learning experience for other students and do little to benefit the disabled learner. This underlines the importance, from an accessibility perspective, of advance dialogue with the commissioner of any production work, in order that teacher and producer can both gain an idea of the pedagogic aims of the resource and its intended role in teaching and learning.

This approach acknowledges arguments that, given the varying nature of accessibility requirements among individuals with specific impairment or combination of impairments, combined with the unique aims and context of an online resource (such as audience characteristics and usage environment), a guideline-based approach is not sufficient to ensure the most appropriate accessibility solutions are provided (Milne *et al.*, 2005). For e-learning accessibility in general, and multimedia in particular, a holistic approach is advised (Kelly *et al.*, 2004, 2005), acknowledging the role e-learning plays in enhancing the wider learning environment.

The need for a holistic approach to multimedia accessibility

In the United Kingdom, the legislation of the DDA does not specify technical requirements that must be met by digital resources in order to avoid discrimination. Accompanying Codes of Practice have been provided to give practical guidance on how unlawful discrimination may be involved—for example, the Code of Practice for Providers of Post 16 Education and Related Services (Disability Rights Commission, 2002), which gives examples of where the DDA might apply in an educational establishment, and what might constitute, in the terms of the legislation, ‘reasonable adjustments’ to practice in order to ensure that unjustified discrimination does not occur. Yet there is little in the way of prescriptive technical information in terms of e-learning design. This may seem at first glance frustrating to e-learning developers, but in fact provides an opportunity to use the most appropriate resources, or combination of resources, to create an optimally accessible learning environment. The use of multimedia may therefore be considered a reasonable adjustment to make to the provision of education in order to reduce exclusion.

To approach the issue of accessibility in relation to a specific multimedia learning resource, there is a need to move beyond a technical definition of the level of accessibility to be achieved, to a wider context. It is easy to imagine a scenario whereby a

developer, given a set of accessibility guidelines, may try to apply inappropriate accessibility solutions. For example, it would be clearly inappropriate to provide captions for a video used in a modern language class to test students' ability to listen and understand spoken dialogue. The Skills for Access resource encourages a holistic approach, establishing context by considering the following points:

- What are the aims, the pedagogic goals of this piece of multimedia? How does the resource fit in with the rest of the learning environment?
- Will all students be required to use it? Is its use compulsory for completion of a course or for assessment?
- Where is the resource intended to be used—a controlled environment like a laboratory or classroom, or potentially anywhere? What assumptions can be made about the browsing and access technology available to intended users (and their knowledge of that technology)?
- What are the potential barriers to using the multimedia resource for its intended purpose? What levels of sensory or motor abilities are required? How might specific learning difficulties or other cognitive impairments affect the ability to use the resource?
- What alternatives already exist and what alternatives can be reasonably created? How was the subject or topic previously taught?
- What is the best way that the information or experiences can be presented such that:
 1. As many as possible of the intended audience can achieve the intended learning objectives using the multimedia resource?
 2. Those affected by remaining accessibility barriers can achieve the same objectives in a way best suited to them?

The answers to these questions should help e-learning developers and media producers establish a sound basis on which to build a strategy for accessible design, and to ensure that the accessibility solutions chosen are most appropriate for the context in which the resource will be used. This proactive approach is required by the need of the UK DDA for educational providers to be anticipatory in the steps they take to accommodate the needs of future disabled learners, and ultimately promotes a culture of accessible design.

Conclusion

The judicious use of multimedia in an educational context offers significant potential in making the learning environment more accessible to disabled students, although this message can be lost in favour of the equally important, but higher-profile, demands that multimedia be provided with additional features to make it accessible. While resources supporting designers improve in quality and quantity, there is still scope for improvement in the support for accessibility of the tools and technologies available to developers and end users to ensure that using online multimedia is as easy as possible regardless of personal access needs. Additionally, given that some

accessibility features do require extra time to implement, production schedules need to consider this from the start, while a more joined-up approach to the provision of accessible multimedia across the wider educational community is also needed.

The need for a holistic approach to multimedia e-learning is clear. E-learning resource developers, multimedia producers and teachers must work together to establish the context of a multimedia resource in order to assess:

- How best the resource in question can enhance the accessibility of the learning environment.
- How to ensure the resource—and the learning experience it provides—is itself as accessible as possible to the target audience.

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Notes

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2. <http://ncam.wgbh.org/webaccess/magpie/>
3. <http://www.edina.ac.uk>
4. <http://www.bufvc.ac.uk>
5. <http://www.skillsforaccess.org.uk>
6. <http://www.skillsforaccess.org.uk/casestudies.php?id=157>
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