Abstract

This paper gives the web developer an insight into the issues of web accessibility for users with Dyslexia (and/or other specific learning difficulties). This paper covers the four main areas of accessibility: presentation, content, structure and navigation. The material covered by this paper forms part of TechDis wider range of research into usability and accessibility issues of electronic educational content.

Keywords: dyslexia, SLD, web accessibility, usability, design.

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1. Introduction

“You can’t just throw information up there, and clutter up cyberspace. Anybody who makes a web site should make the effort to organise the information.” (Morkes and Nielsen, 1997).

Within the education sector the use of electronic materials is increasing, with lecture notes and study materials being put online to allow the student to access the materials in their own time and at their own pace. Virtual Learning Environments (VLEs) and Intranets are being increasingly used as a means of delivery and storage of learning materials.

“It is estimated that between 1.2% and 1.5% of students in Higher Education in the UK are dyslexic” (Singleton, 1999), though the number of students has been steadily increasing over the last few years. This is due to the positive effect of the Widening Participation Initiative (WPI) and the increased awareness of the condition leading to more diagnosis and increasing numbers of students with dyslexia progressing into tertiary education.

“Although awareness and support for dyslexic students has increased dramatically in the past decade” (Gilroy & Miles, 1996), there is need for the awareness of accessibility issues for electronic mediums for dyslexic students to be increased.

Current Web Accessibility Initiatives (WAI) and other accessibility guidelines mainly focus on the research affecting people with visual impairments and the Blind. There is, however, little research available that specifically deals with the issues surrounding accessibility for people with dyslexia and other Specific Learning Difficulties (SLDs), hence the production of this paper.

The accessibility of electronic material is affected by a whole range of issues, not just the ‘readability of the text’, but also some of the common difficulties that face readers of the printed page. These issues cover such diverse aspects as readability, user control over presentation and information architecture.

This paper brings together knowledge derived from practitioner’s experience, and usability research. Furthermore, it attempts to draw some conclusions (and make suppositions) about the needs of dyslexic students with known dyslexic difficulties and their implications when using electronic material. Most of the advice contained within this paper can be applied to HTML web pages, word processing documents and Postscript files though some aspects as specific to particular formats.

The paper also includes much of the practical knowledge gained from TechDis’ wider web accessibility work.

Further information can be found at: http://www.techdis.ac.uk/seven/
2. Explaining Dyslexia

Students with dyslexia often have problems with:

- Visual processing (inc. scotopic sensitivity),
- Phonological decoding, analysis and processing,
- Reading and comprehension,
- Auditory processing,
- Memory recall,
- Structure and sequencing,
- Planning and organisation.

These problems have an impact on the user’s ability to read, write, navigate, comprehend and recall relevant information from electronic materials e.g. web sites. “In addition, within the dyslexic population as a whole a number of underlying processing difficulties present themselves as various sub-types of dyslexia” (Siegel, 1994; Rack, 1996). Combining this with the many different learning styles and study strategies leads to a wide spectrum of not only skills but also difficulties.

In academic situations these difficulties can have more widely ranging effects than simply difficulties with reading. It has been shown that dyslexic students also display “difficulties with the academic related skills of preparing a précis and in proofreading” (Snowling, et al 2002).

Dyslexic students can have difficulties with visual processing, leading to slow visual object recognition and problems with visual concentration and/or over-sensitivity to light. This means that dyslexic students can be affected by both the aesthetic qualities of a Graphical User Interface (GUI) and the visual readability of the content.

Dyslexic students usually have problems with phonological decoding, analysis and processing (the ability to recognise, produce and sequence letter sounds) that often results in difficulties acquiring proficient skills in reading, writing and spelling. “Although reading and spelling problems may be compensated for to varying degrees, the residual difficulties of dyslexic adults typically includes slow reading speeds, phonetic spelling and poor written expression” (Snowling, et al, 2002).

Dyslexic students commonly have problems with short term and working memory, structure and sequencing. This can have a huge impact on the accessibility of information, and more broadly the accessibility of information architecture. The effect of short-term memory problems and sequencing can mean an increase in the likelihood of a dyslexic student becoming lost in a hypertext structure. More specifically one could suggest that since the recall of information in a reversed sequence is problematic (which can be demonstrated by using the reverse digit span test), it suggests that they will have more problems in backward navigation (returning to a higher level within a hyper text structure).
3. Accessibility of a web site’s graphical presentation

Colour and contrast issues

- The choice of colour for images, text and background is important, and it is advisable to provide sufficient contrast between elements of a page.

- Colour should not be used as the only means of distinguishing different sections of content (e.g. red text for important text). However, colour can be effective when used in combination with clear labelling to highlight various sections on pages, paragraphs and categories.

- The most important contrast should be between the background and text. A background should be a single, solid colour. Where possible, avoid loud textures, patterns or images. However, do not rely on the background as the sole means of contrast as some users’ browsers may not display the chosen colour or form. When choosing colours, use a dark text on a pale background, for example dark blue on cream. Using ‘web safe’ colours (256 colours that are available on the majority of browsers) should help to ensure interoperability.

- Avoid green and red/pink combinations as these are can cause confusion for colour-blind users. Red and green should not be used on top of one another or side-by-side where confusion can occur. Users might be able to differentiate the red from the green (as is the true effect of protanopia and deuteranopia); they could be mistaken by picking the wrong one. Green by itself and red by itself should not cause any problems. Red on black and vice-versa is another issue for protanopes.

- Some people with dyslexia suffer from scotopic sensitivity (otherwise known as Meares-Irlen Syndrome) that means that they find high contrasts difficult to read, such as black on white. This can cause visual effects such as rivers of white space.

![Image](https://example.com/image.png)

**Figure 1.** The rivers of text effect. Helen Irlen, (2002)

- Ensure that sequential presentation allows enough time for a slow reader (who may have to decode each word separately) to keep up.
• Do not continue a presentation until the user is ready; provide user control.

• Always allow the user to go back and re-read information.

It is important to remember that colour is very much an individual choice; what works for one person may not work for another.

**Page design issues**

“Layouts should be designed to reduce the cognitive burden associated with spatial visualization and visual-motor coordination. Designers should focus their efforts on creating interfaces that appropriately group information by function” (Dodson & Shields, 1978).

“Designers should reduce overall information density to less than 50 percent of the screen area” (Horton, 1989). It is helpful to provide sufficient ‘white space’ to guide the reader from one point to another and allow time for the material to be absorbed.

“When a page comes up, users focus their attention on the centre of the window, where they read the body text before they bother looking over header bars, or other navigational elements” (Morkes and Nielsen, 1997). This implies that visual presentation of navigational mechanisms should clearly standout from the body of the text. This can be achieved by using a combination of grouped layout, colour, size and underlining of hyperlinks.

“Students used elements (icons) as their first cues to identify course content, but used accompanying text links to help clarify that content.” (Blankfield, et al, 2002)

Use graphics, images, and pictures to break up text, whilst remembering that graphics should be relevant to the material and not distract from the content. Bear in mind that graphics and tables may take a long time to download.

**Why is printing important?**

Web pages should ideally be themselves, or provide printer-friendly documents. Users with dyslexia may have a slow reading speed and so take longer than normal to read through large amounts of text. By providing a printable alternative to the webpage, the user can read the page offline in their own time. Students may often find the printed page easier to revise from, due to the kinesthetic learning effect of having the pages at hand. In fact, numerous research studies show that text revised on screen tends to be digressive, unfocused, chattier, and less concise (Tate, 2000).

Since monitors are luminous and paper is reflective, paper copies might be easier to read from for some users with scotopic sensitivity. This will also allow them to keep a copy for later reference as well as encouraging annotations and even graphical note taking. This learning strategy was adopted by many of the students from the Edge Hill study (Blankfield, Davey and Sackville, 2002).
Web developers can use a Cascading Style Sheet (CSS) to separate coding for the presentation of a page from the actual content. This means that a separate CSS can be created for on-screen presentation and another CSS for printing, without duplicating content and effort. A web site developer could instead provide a separate printer-friendly version of each page, though this can often take more work.

Consider the width of columns

- The width of the ‘reading line’ can have a large impact upon readability, for both comprehension and the user’s comfort.
- Use a fluid design so that column widths can be resized by adjusting the user’s browser window size. (This is achieved by using relative units such as percentages for the width of table columns.)
- Horizontal scrolling should be strictly avoided.

Visual accessibility of the text

Fonts should be:

- easy to read,
- have clear definable letter shapes,
- have clear spacing between letter combinations.

Bear in mind that fonts with unusually shaped letters, script fonts and novelty fonts can be difficult to read.

The following four fonts have been designed for on-screen reading or may be easier than others to read from the screen.

<table>
<thead>
<tr>
<th>Verdana Font</th>
<th>Georgia Font</th>
</tr>
</thead>
<tbody>
<tr>
<td>The quick brown fox jumps over the lazy dog.</td>
<td>The quick brown fox jumps over the lazy dog.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tahoma Font</th>
<th>Trebuchet MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The quick brown fox jumps over the lazy dog.</td>
<td>The quick brown fox jumps over the lazy dog.</td>
</tr>
</tbody>
</table>

- Use sans serif fonts such as Arial (Helvetica) or Comic Sans. Other suggestions include Verdana, Georgia, Tahoma and Trebuchet MS.
- For printed documents should use a minimum of text size 12pt or 14pt.
However, it’s well known that Comic Sans is not regarded as a professional font, nor is it cross-platform compatible – but experienced dyslexia support practitioners have found that dyslexic students find this a very readable font.

Further information on font readability:
http://www.mcu.org.uk/articles/accessibletext.html

**Avoid underlining except for hyperlinks**
Don’t underline large blocks of text as it makes reading harder. Underlining usually indicates hyperlinked text; it can be confusing for users if it is used where no link exists.

Conversely, always underline hyperlinks as users expect to be able to recognise hyperlinked text or images.

**Do not use blinking text or moving text**
Ensure your site does not use blinking text tags or marquee (scrolling) text as this is very hard to read and can distract the user from the important content. Moving text creates problems for people with visual difficulties. It also creates a difficulty for text-reading software.

**Avoid the use of capital texts**
Text in all-caps is much harder to read than normal-case continuous text. One or two words set in capitals should not create too many reading problems.

Because they are bigger, capital letters are easier to see than lower-case letters, so may be suitable for labels. Do not capitalise whole sentences, as this can be visually distracting and annoying to the reader. It appears as if you are SHOUTING!

**Keep to left aligned, un-justified text**
Justified text causes uneven inter-word spacing, which can create ‘rivers of white space’ for some dyslexics. (See figure 1.)

- In word processing documents limit lines to 60–70 characters and in web pages consider the average column or table width. Lines that are too long or short can put strain on eyes due to increased physical movement.
- Use line spacing between paragraphs to break up text.
- Use headings and wide side margins.
- Use boxes for emphasis or to highlight important text.
- Avoid dense blocks of text by using short paragraphs.
- If appropriate use bullets or numbers rather than continuous prose.
- Don’t hyphenate words that are not usually split in order to fill up line ends, e.g. "continuation".
- The space between lines is important. Research suggests a leading (space) of 1.5 to 2 times the space.

(Adapted from the X04Frendly. BDA, 2000.)
User control over presentation

It is important to check whether the page’s visual design can be overridden by user style sheets.

Some dyslexic students customised their PCs in some basic ways, commonly:

- Changing background colours,
- Changing text colours,
- Enlarging text (within a browser and in the operating system).

(Taken from the Edge Hill Study [Blankfield, et al, 2002].)

The following example forces the background of web pages to pale cream and the standard text to black.

```html
BODY { background: #FFFFCC !important; color: #000000 !important; }
```

Further information can be found at: http://www.techdis.ac.uk/seven/wizards/

4. Accessibility of a web site’s content

Consider how accessible the actual content is to the user

Research shows that readers access text at a 25% slower rate on a computer (Nielsen, 2000). This should be taken into account when putting information on the web.

“Put key information, instructions and tasks towards the top of a page – and/or introductory text explaining the page/section content and expectations” (Blankfield et al, 2002).

Readability of the text is crucial for a usable educational web site

In a study by Morkes and Nielsen called “How to write for the web”, fifteen out of nineteen participants approached unfamiliar web-based text by trying to scan it before reading it.

The same study suggests that “scannable, concise and objective writing styles each make a positive difference in web users’ performance and subjective satisfaction sentences” (Morkes and Nielsen, 1997). It was also suggested that simple and informative writing is preferred over most other forms.

It was found that users presented with concisely written text had 42 percent better memory recall of the site’s content than the control users who were presented with standard promotional web text. It was also found that the users made significantly fewer task errors than the control users.
“Elements that enhance scanning, include headings, large type, bold text, highlighted text, bulleted lists, graphics, captions, topic sentences, and tables of contents” (Morkes and Nielsen, 1997) are to be included where possible.

Making content readable for those with dyslexia
People with dyslexia and other SLDs may not have the ability to scan through documents as a means of speed reading, but they might be able to use their reading time more effectively if they are able to identify the sections they are in or the topic that the text is covering.

Authors should try to write in a clear, consistent and concise manner. Material should be written at an academic level suitable for the intended audience.

“Make information explicit – especially the learning outcomes, assessment criteria, and online expectations. Don’t let this information get lost amongst other material.” (Blankfield et al, 2002).

Ensure screens are not crowded and provide enough white space
A limited amount of information should therefore be presented on a page so that scrolling is avoided and memory overload is lessened.

The way in which text is written can have an impact on the reader. Long and complicated sentences can be difficult for the reader to navigate and comprehend.

- Use short simple sentences with clear instructions.
- Use concise paragraphs with clear topic headings.
- Be conscious of where sentences begin on the page. Starting a new sentence at the end of a line makes it harder to follow.
- Give instructions clearly. Avoid long sentences of explanation.
- Use bullet points or numbering for lists.
- Where appropriate use graphics that explain any complex text.
- Use the ABBR and ACRONYM mark-up to explain abbreviations and acronyms.

Use highlighting to emphasise keywords and concepts
Use bolding to highlight in order to emphasise keywords and concepts. Preferably use the structural elements <em> or <strong> (emphasized text and strongly emphasized text respectively) to mark up content rather than the presentational elements <b> or <i>. Ensure that Cascading Style Sheets are used to present a bolded, non-italic and not underlined text for these tags. A different colour could be used to visually distinguish.

Highlighting (the background) is a very good way of drawing the attention of a reader to the main points of the text. Adding colour can increase the likelihood that the information will enter the long term memory.

Title paragraphs for better comprehension
According to Bransford and Johnson (1972), participants who have read passages with titles recalled approximately twice as many items from the
passages and had higher levels of comprehension than participants who did not have passages with titles.

**Use alternative content**

Everyone has different learning styles. It is important to consider this when presenting ideas and concepts.

The following learning styles as described below are commonly used to explore a dyslexic’s skills and difficulties.

Consider the following learning styles from Bandler & Grinder (1982)

**Visual Learners:**
Learning through seeing. Learners in this category prefer to see pictures or diagrams. They like demonstrations, reading or watching video. Visual learners are usually stronger, faster readers and would rather read, than be read to. Some people might find it easier to access a long and wordy explanation whilst others may prefer an alternative style. The visual learner likes to have information presented through images, diagrams, visual representations of relationships etc.

**Auditory:**
Learning through hearing. Learners in this category like to listen to audio tapes, or to learn through lectures, debates, discussions and verbal instructions. Auditory learners are easily distracted by noise and tend to need to say a thing to remember it. They find writing more difficult and prefer aural and oral communication. Even material which uses a number of multi-media clips, video and/or audio elements, is going to make a lot of demands on visual skills.

**Kinaesthetic:**
Learning through doing. These learners like to be hands-on, manipulating objects and experiencing learning directly. They have trouble in remembering abstract ideas and rely on reinforcement exercises to really be able to conceptualise and remember ideas.

From understanding these styles we should consider using:

- A contents page at the beginning and an index at the end of long documents.
- Flow charts for explaining procedures.
- Diagrams to help explain spatial concepts.
- Pictograms and graphics which help to locate information by attracting the eye and stimulate the visual memory.
- Lists of dos and don’ts, which are more useful than continuous text to highlight aspects of good practice.
- A glossary of abbreviations and jargon. (If possible use the abbr element in HTML).
- Audio files of text passages.
- Videos to demonstrate visual concepts.
• Use keyword captioning on videos to aid comprehension and memory recall.

“Words and pictures can be a powerful combination, but they must work together” (Morkes and Nielsen, 1997). Images can be used to mark a difference between pages and can also be used to identify sections of a site. Images should only be used to supplement the text, in that they provide an alternative presentation of information, which is especially useful when describing a visual concept.

The serialist versus the holist

Often dyslexics describe themselves as thinking differently from others. It is believed that they think holistically, and that they see others as thinking linearly.

Gordon Pask (2001) developed an overall systems approach to learning which is highly abstract and difficult, although rewarding: it is reflected in the “conversational” models of learning of Laurillard (2002) and Thomas and Harri-Augstein. Pask conceived two different kinds of learning strategy: "serialist" and "holist".

“When confronted with an unfamiliar area, serialists tackle the subject step by step, building from the known to the unknown with the simplest possible connections between the items of knowledge. Holists, on the other hand, seek an overall framework and then explore areas within it in a more or less haphazard way, until they have filled in the whole" (Atherton, 2002).

Avoid multi-sensory overload or bias.
Do not provide video or audio content unless on the user’s demand, i.e. do not start an audio file automatically when a page loads; instead allow the user to control playback of the audio file.

Ensure that equal content is provided by text and multimedia. Do not rely on multimedia to provide content.

Making text usable when read-aloud by text-to-speech software

As explained earlier some learners find hearing text read aloud helps learning. Assistive technologies such as a ‘text-to-speech program’ or a full-fledged ‘screen reader’ can be used to produce synthesised speech of the text being read aloud. There are a number of points to bear in mind when preparing information for use with text-to-speech programs.

• Use semi-colons, commas, or full stops after bullet points in order to separate each point.
• Number menu items to aid navigation.
• Don’t write words purely in capital letters, as they may be read as single letters.
• Avoid the use of ASCII text and unnecessary symbols (e.g. # – :-> ) as these will be read aloud by a text-to-speech program.
• When using text documents always punctuate abbreviations, e.g. BDA should be B.D.A.
• Use alt attributes for images especially where they have functional uses e.g. “link to homepage”. Also use empty alt (alt=””) attributes for presentational images that do not convey any information.

(Adapted from the X04Frendly. BDA, 2000.)

5. Accessibility of a web site’s information architecture

Navigation mechanisms

Navigation should be easy! Finding items and moving around a site should be obvious and intuitive to the user, not just the designer.

The provision of a site map is essential, as it aids the user in the construction of a conceptual or cognitive map of the sites structure.

• Try to make any page no more than 3 links away from the homepage or sub-section index page.
• Do not use random images that require a mouse rollover to see the destination of the link for navigation elements.
• Use the a:visited style to make a visited link visually distinct from an unvisited one. Visited links are often given in a purple colour.
• In the body of text always underline hyperlinks as users expect to be able to recognise hyperlinked text or images.
• Use colour to divide pages into various navigational or content sections, though use colours safe for colour-blind users or provide text alternatives.
• Use text and symbolism for navigational elements that are truly representational or a well known concept e.g. a house for home.
• Ensure consistency between all pages throughout the site with an indication of where the user is at any one time e.g. bread crumb trail or similar device. If possible use a combination of mechanisms to provide alternatives.

(Adapted from the X04Frendly. BDA, 2000.)

Consider the use of a breadcrumb trail to give the user a perspective of their location within the site’s structure. (E.g. Home page > section > sub-section). These should use active hyperlinks so they can be used as a navigational mechanism.

Provide clear intuitive categories for menus and links and ensure they are grouped accordingly. Do not provide alphabetical links lists for menus as the user is then required to guess the link titles in order to know where to look within the alphabetized column listing (Bernard, 1999). It has been found that search time is
significantly faster when links are grouped in columns rather than rows (Nygren, 1996)

**Use front-loaded hyperlinked sentences** to allow for easy scan reading.

e.g. [Hyperlink title], further details about the link.

**Use bullet pointed lists to present a list of hyperlinks**
Using hyperlinks in a bulleted list decreases the likelihood of a user making a navigational error. Bullet hyperlinks provide more space between links and increase the readability of the individual link titles. The Edge Hill study suggests using full line spacing between links to make them easier to read.

**The hypertext page problem (Mark Hurst, 1999)**

“The hypertext page problem states that on any given Web page, users have a particular goal in mind, and this goal drives their use. Either they click on a link that they think will take them toward the goal, or (seeing no appropriate forward clicks) they click the Back button to take another path.”

Users often become lost within a web site's structure. They may find they don’t know where they are, where they are going or where they have been. It is essential to provide contextual navigation clues to enable a user to determine their location within the overall structure of the site.

66.8% of users have stated that one of the greatest problems about the Web is "not being able to find the information that I am looking for" (GVU, 1998).

58% of users will make two or more navigational errors while searching for information (Forsythe, et al., 1996).

**If possible provide an internal search facility**
Many users approach a web site by using a ‘search’ strategy and go straight for the search engine or internal search box to find the information they seek.

**Site-design issues**

**Provide help for the user**
Provide context-based help and suggestions; try to anticipate possible common problems.

One useful method to assist the user is to provide a series of ‘Frequently Asked Questions’ (FAQs), where you can try to anticipate possible common problems on your site. This also gives the author a platform from which to answer issues that arise.

A feedback or comments form can also provide the basis from which to build a FAQs web page.
Errors can be created by 'dead', 'inactive' links or invalid URLs. These types of errors often result in a browser displaying a standard 'error page' such as the Internet Explorer HTTP 404 error page. If possible the site should provide more useful suggestions than the standard page.

**Deal effectively with invalid search or form field entries**

When a form field is used for users to input information they must be given sufficient guidance to know which fields are mandatory (must be filled out) and those which must contain a particular format of data entry.

- For example: If a user tries to search with a blank or empty input field, then the user should be told that they have not entered anything into the 'search field'.
- If a series of fields are used to request the user’s address and the post code field is required before the user can proceed, the text should explain that directly rather than through the use of a red letter label or asterisk (*) by the label.
- If a date is required, then within the text the user must be told to enter the text in a certain format e.g. dd/mm/yy.

**Provide an easy-to-use, intelligent search facility**

Try to provide a search engine for your site as it may help users locate particular information quickly.

If possible when using search engines:

- Always put the search box in a clear obvious position, usually the top of the page.
- Try to limit the search or provide 'search within results' so that the user is not over-burdened with too many results.
- Make the links to 'next page' (sometimes numerals) clear and obvious
- Provide the title of each search result page and its URL.
- Offer a search engine that is forgiving of spelling errors.
- Inform users when they have entered nothing in the search or query box.

**Issues of the site’s overall structure**

A common problem for a user when navigating a site is the sense of getting lost. This can be exacerbated when the user takes digressive links that there is no obvious route to back track through. Therefore consider carefully the use of digressive hyperlinks embedded within text.

Generally, it has been found that people make fewer navigational mistakes if the hierarchical structure of the site is broader rather than ‘deeper’. The reasoning is
that “the deeper the level, the more a user has to rely on short-term memory” (Bernard, 2002). This means for people with short-term memory difficulties ‘deep’ complex structures can be confusing as they have further to go (more links to follow) back or forward.

Also, with ‘deeper’ structures, the hyperlink titles are often vaguer at the higher levels; at each deeper level the titles become more specific. With deeper structures users might find it difficult to figure out which way to navigate and remember the path they took.

When sites must use ‘deeper’ structures, user browsing for specific information will find this information faster if the structure is concave (breadth of 8 x 2 x 2 x 8). Stated in a more simplistic manner, sites structures should be broad (providing links to many pages) at the top and lowest levels, while the interior of the structure should be narrow (with fewer hyperlinks to pages).

![Figure 2. A concave site structure, breadth of 6 x 2 x 2 x 5.](image)

The idea is that the broad level at the top will provide enough information to enable to the user to take the correct path, whilst the broad level at the base will allow the user to select the specific information. The use of a narrow interior reduces the chance of the user getting lost as they have fewer links to choose from and hopefully less chance of becoming disoriented.

**Provide common documentation/information pages**

**Homepage** – The default page the user always hyperlinks back to, containing links to the navigation paths.

**Contacts page** – A page containing the organisation's name, address and email.

**Site Map** – This page provides directional links for the content of the entire web site.

**References or Links Pages** – A page which is useful on educational sites to provide a separate resource page for referencing other sources of expertise, further information and links to other sites.

**Copyright or Disclaimer pages** – A page or pages in which details of legal copyright and disclaimer information can be provided.

**Accessibility statement** – A page could be provided to assist a user in using the site effectively with different accessibility needs.
6. Conclusion

Hopefully this paper will highlight the issues surrounding the accessibility and usability of electronic documents for students with dyslexia.

A dyslexic student’s difficulty with visual processing can mean that the accessibility of a web site’s graphical presentation can have a large impact upon the readability of a site’s content. One of the most important factors is that of the visual readability of the text (both the choice of font and the contrast of the text and background colours).

The way in which the information is presented and structured can have a considerable influence on a dyslexic student’s recall and comprehension of the documents content. Documents should be well structured, breaking text down into manageable and sensible chunks. Avoiding large paragraphs that are too intense to read and long pages where it is too easy to lose track.

The common dyslexic problem with short term and working memory means that the clarity and usability of navigation mechanisms remains critical. Documents and web sites should be intuitively structured with clear headings and subsections.

One of the main conclusions drawn from this paper is the need for tutors and developers to be aware of the diversity of perceptions of content, learning styles, cognitive limitations and learning strategies. They need to build in alternatives for both the visual presentation and in the mode and medium of the learning material.

7. Useful resources

Papers


Web sites


