Ensuring accessibility of electronic information resources for visually impaired people – the need to clarify concepts such as visually impaired

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Abstract

Purpose: The article addresses the importance of clarifying terminology such as visually impaired and related terms before embarking on accessibility studies of electronic information resources in library contexts. Apart from briefly defining accessibility, the article attempts to address the lack of in-depth definitions of terms such as visually impaired, blind, partially sighted, etc. that has been noted in the literature indexed by two major Library and Information Science databases. The purpose is to offer a basis for selecting participants in studies of accessibility of electronic information resources in library contexts, and to put discussions of such studies in context.

Design/methodology/approach: Clarification of concepts concerning visual impairment following a literature survey based on searching two major databases in Library and Information Science. To put the discussion in context accessibility is also briefly defined.

Findings: Although visually impaired and a variety of related terms such as blind, partially sighted, visually disabled, etc. are used in the Library and Information Science literature, hardly any attempt is made to define these terms in depth. This can be a serious limitation in web and electronic accessibility evaluations and the selection of participants.

Practical implications: Clearly distinguishing between categories of visually impaired people and the ability of sight of participants is important when selecting participants for studies on accessibility for visually impaired people, e.g. the accessibility evaluation of websites, digital libraries and other electronic information resources.

Originality/value: The article can make a contribution to the clarification of terminology essential for the selection of participants in accessibility studies, as well as enriching the literature on accessibility for visually impaired people in the context of Library and Information Science.

Keywords: Accessibility, visually disabled, concept clarification, blind, visually impaired, partially sighted

Paper type: Conceptual paper

1 INTRODUCTION

Considering the growing activity in designing digital libraries, portals, intranets, repositories and databases, and libraries promoting the use of Web2.0 technologies, it seems timely to note concerns to ensure that information is available to all. Concerns to design for visually impaired users should especially be headed. Many books, articles and guidelines have appeared in the Library and Information Science (LIS) literature, and even more in the wider context of education, e-government, e-commerce, health and information and communication technologies (e.g. Abu-Doush et al, 2013; Atinmo, 2007; Axtell and Dixon, 2002; Beverley, Bath and Barber, 2011; Byerley and Chambers, 2002).

A clear understanding of the concept of “visually impaired” and its finer nuances is very important when library and information services design and evaluate electronic information resources in terms of accessibility to visually impaired people, and selecting visually impaired participants to assist in such evaluation. A variety of terms are used in the subject literature: visually impaired, visually disabled, blind, partially sighted, non-sighted, etc. These terms are often not explained or clarified, and hardly ever in any depth that clearly distinguish the finer nuances. This article will therefore consider the importance of clearly establishing the interpretation of “visually impaired” and related terms, before embarking on accessibility studies. The article follows from a dissertation of limited scope by Kleynhans (2009).

When trying to assure accessibility for visually impaired people, two concepts must be clarified:

- Accessibility
- Visually impaired

2 ACCESSIBILITY OF ELECTRONIC INFORMATION RESOURCES

When assessing the accessibility of electronic information resources and designing for such accessibility, the meaning of accessibility and its related terms should first be clarified; there should be clarity on what is being accessed and the target population to whom it applies. To put accessibility in contexts note should, however, also be taken of universal accessibility and usability ─ closely related terms. A first step in ensuring accessibility to electronic information for visually impaired persons would be to ensure that they have computer access, normally requiring a computer as well as assistive technology. Assistive technology refers to "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (http://www.resna.org/taproject/library/laws/techact94.htm). In the LIS literature the use of assistive technology has been reported by amongst others Fitzpatrick (2010) and Koulikourdi (2008). Brophy and Craven (2007) highlight the fact that the terms “assistive”, “adaptive”, “access” or “enabling” technology are often used interchangeably.

Design for accessibility must be seen in the context of universal design. According to Van der Heiden (1996) universal design is the process of creating products (devices, environments, systems and processes) which are usable by people with the widest possible range of abilities, operating within the widest possible range of situations (environments, conditions and circumstances). The International Organisation for Standardisation (ISO) has a technical specification (ISO TS 16071) (Gulliksen and Harker, 2004) which provides guidance to developers on designing human-computer interfaces (such interfaces are very important when using electronic information resources) that can be used with as high a level of accessibility as possible. This can

promote increased effectiveness, efficiency and satisfaction for people who have a wide variety of capabilities and preferences (Gulliksen and Harker, 2004). The ISO technical specification is based on the concept of universal design.

According to the ISO definition, accessibility is also strongly related to the concept of usability. Accessibility is defined as the usability of a product, service, environment or facility by people with the widest range of capabilities (ISO TS 16071). The American National Standards Institute/Human Factors and Ergonomics Society (ANSI/HFES) approved ANSI/HFES 200 Human Factors Engineering of Software User Interfaces 200 in 2008 (Human Factors and Ergonomics Society, 2008). ANSI/HFES 200 defines accessibility as the set of properties that allows a product, service or facility to be used by people with a wide range of capabilities, either directly or in conjunction with assistive technologies. Usability is defined as "the extent to which a product can be used by specified users, to achieve specified goals, with effectiveness, efficiency and satisfaction, in a specified context of use" (*ISO 9241 Part 11 - Guidance on Usability*). When considering the accessibility of electronic information resources, the capability of visually impaired people should therefore be considered.

The University of Bristol summarises the two concepts of "accessibility" and "usability" on their accessibility Web page as follows: "Accessibility is ensuring that all users can access all services and content, while usability is ensuring that the process of accessing services and content is as intuitive and efficient as possible" (University of Bristol, Library and Computing Services, 2008).

Thus accessibility aims to enable users and to make access to content possible for everyone, regardless of disability or the type of device that may be used. Usability focuses on improving the user experience and includes aspects like learnability (ease of use), memorability (remembering how to use), effectiveness (ease of navigation and understanding), efficiency (accessing information in a reasonable time), and satisfaction (enjoyment of use) (University of Bristol, Library and Computing Services, 2008). As has been pointed out earlier, visually impaired people would use assistive technology to help them. It is important to note that accessibility does not automatically imply usability and vice versa. A highly usable website therefore does not guarantee accessibility. The ideal is to apply both accessibility (and Web accessibility) and usability principles in design to achieve the goal of universal design (inclusive design or design for all).

For purposes of this article accessibility is therefore accepted as the generic term that refers to the accessibility of a product or service (e.g. buildings, cell phones, computer applications, the Web) to people with a wide range of capabilities. Aspects like the choice of assistive technology and the skill of the user in using this technology are factors that may influence the user's accessibility experience. Computer access (and therefore also access to electronic information resources) for a visually impaired user can therefore be defined as being able to effectively interact with the electronic information resources via a computer, using assistive technology. Access to electronic information resources including the Web are however also dependent on the concepts of universal design, accessibility and usability which assume adherence to technical design standards.

When accessing the accessibility of electronic information resources in a library context, it should be understood what accessibility implies (in conjunction with the related concepts), and it should be clear for whom accessibility is assessed: what is meant by visually impaired users, who would they be and based on what grounds

and categories should they be selected to participate in accessibility studies of electronic information resources? It is therefore necessary to consider definitions of visually impaired.

3 REVIEW OF THE LIS LITERATURE ON DEFINING VISUALLY IMPAIRED

When planning an evaluation of the accessibility of a website, portal, digital library or other electronic information resource in a LIS context, the first step would be to learn from the work of others and to search databases in this field for appropriate literature. A next step would be to move to literature in the more general context, to interpret the methods and findings of similar projects and then to formulate an own framework for accessibility evaluation, and to select participants.

As part of the literature review two major databases in the field of library and information science were searched, namely Library and Information Science Abstracts (LISA) and Library, Information Science Technology Abstracts (LISTA; an EBSCHost database available for free). The search strategy required the terms “visually impaired”, “visually disabled”, and “blind” to appear in the title of publications. These were combined with “accessibility” which could appear anywhere in the record (e.g. title, keyword, abstract). A second strategy following the literature review used terms such as “visual impairment”, “partially sighted”, “sightless”, “blindness”, “print handicap”, “print handicapped” – again combined with “accessibility” appearing in the record (e.g. title, keyword, abstract).

Only English language publications were considered for in-depth review, and only publications that could be obtained. From these the following were noted in terms of the use and clarification of terminology (not intended as a comprehensive review).

Abu-Doush et al (2013), Andronico et al (2006), Atinmo (2007), Bayer and Pappas (2006), Beverley, Bath and Barber (2011), Brarazier (2007), Burrington (2007), Byerley and Chambers (2000), Carey (2007), Chapman (2007), Craven (2001), Cylke, Moodie and Fistick (2007), Davies (2007), Evett and Brown (2005), Davis (2003), Fernandes et al (2012), Guercio et al (2011), Harper, Goble and Stevens (2005), Hunsucker (2013), Johnson (2000), Kouroupetroglou *et al*. (2007), Lescher, John and Ojala (2000), Lewis and Klauber (2002), Murphy *et al*. 2008, Owen (2007), Rogers, Mark and Rajkumar (1999), Roos (2007), Sahib (2012), Tank and Frederiksen (2007), Valenza (2000), Walsh (2006), Yang, Hwang & Schenkman (2012)	These authors use terms such as “blind”, “visually impaired people (VIPs)”, “sightless”, “sighted”, “partially sighted”, “visually disabled”, “profoundly blind” or more than one of these in an article, but do not define or clarify the terms (at least not in any detail). There is no reference to different scales or categories of being able to see.
Tucker (2007)	The author uses the terms "blindness," "visual impairment," and "print handicap", and argues that definitions are important since they affect the types of projects and the target groups. According to Tucker (2007) “Blindness is a scale of measures from seeing absolutely nothing to having partial sight up to

	the level that the government sets as the limit to be registered as blind".
Brophy and Craven (2007)	The authors refer to people who are blind (either totally blind or with no useful sight) and who need to use screen reading technology or refreshable Braille to access the Web. They also distinguish people with a visual impairment who need to use screen magnification or screen enlargements/adjustments.
Venter and Lotriet (2005)	According to the authors, visual disability includes complete blindness, colour blindness and poor sight to the extent that a screen magnifier is required when working with computers.

From the above it seems as if "visual impairment", "visually impaired" and related terms are seldom clearly defined in the LIS literature dealing with accessibility and accessibility studies. Neither are categories and classifications of sightedness acknowledged in much depth.

4 EXPLORING AN IN-DEPTH DEFINITION OF VISUAL IMPAIRMENT

4.1 The concept

In a study by Kleynhans (2009) of the research literature on accessibility for visually impaired people and accessibility studies it became clear how complex and confusing the definitions and classifications of visual impairments are. Much of the ignorance about visually impaired people can probably be attributed to ignorance about the definitions and classifications of visual impairments and what they equate to on a functional level. Considering the lack of such definitions in the LIS literature (as indicated in the preceding section), the term will now be dealt with in more detail based on the study by Kleynhans (2009).

From the study of the wider literature it seems as if the terms "visually impaired", "partially sighted" and "low vision" are often used interchangeably, indicating some level of residual vision. The World Health Organization's (WHO) classification of visual impairment can offer an important point of departure in this regard with more details of this classification to be found as part of their International Classification of Diseases (ICD 10) (http://www.int.classifications/icd/en/). This classification includes definitions for only two of these terms, namely low vision and blindness. The term "visual impairment" is used to indicate the category of impairment in both low vision and blindness. The term "low vision" includes people with a visual acuity that falls in the range less than 6/18 and greater than or equal to 3/60. The term "blindness" includes people that have a visual acuity that falls in the range less than 3/60 to no light perception. People with a visual field (peripheral vision) of less than 10 degrees are classified as blind, even if the central acuity is not impaired.

To put these definitions into perspective: A visual acuity of 3/60 means that an affected person would have to stand 3 feet away from an object to see it with the same clarity as a normally sighted person standing 60 feet from the same object. A normal field of vision measures 180^{o}. An affected person with a field of vision measuring less than 10^{o} has severe restriction of peripheral vision (tunnel vision).

The visual acuity and visual field of people who are categorised as blind fall within a range of values. This means that most blind people have some level of vision ranging between 3/60 and no light perception.

A person's level of visual impairment has a direct effect on the individual's functional abilities. Reading and writing abilities/limitations are of particular interest when assessing accessibility in the context of LIS information resources. The individual's functional ability will determine his selection of reading and writing methods and of appropriate assistive technology. Some people may be able to read large print, while others may require reading material in an audio or Braille medium. Visually impaired persons need to use alternative strategies to affect computer access. A wide range of assistive technology devices are used for this purpose e.g.

- screen magnifiers, which are used by people with low vision to enlarge and change colours on the screen to improve the visual readability of rendered text and images.
- screen readers, which are used by people who are blind or have reading disabilities to read textual information through synthesized speech or Braille displays.
- voice recognition software, which may be used by people who have some physical disabilities.
- alternative keyboards, which are used by people with certain physical disabilities to simulate the keyboard.
- alternative pointing devices, which are used by people with certain physical disabilities to simulate mouse pointing and button activation (Kleynhans, 2009).

This would be important when selecting participants for an evaluation.

To put the definition of the concept of visual impairment further in context the classification systems of visual impairment, models of disability and categories of impairment and disability will be considered in more detail.

4.2 WHO standardised classification system for visual impairment

The WHO standardised classification system for visual impairment will now be discussed in more detail. Consideration will also be given to whether this classification system can be used as the basis for studies assessing web accessibility. More detail on the WHO classification can be found at (http://www.who.int/classifications/apps/icd/icd10online/). The WHO Classification of Severity of Visual Impairment is part of the WHO ICD-10. Two aspects of vision are taken into account in this classification, namely visual acuity (expressed as a fraction) and visual field (expressed in degrees).

The WHO classifies low vision and blindness as in Table 1 below in terms of visual impairment categories (1-5). These categories of visual impairment are depicted in Table 2 in more detail. The term "low vision" in Table 1 comprises categories 1 and 2 of Table 2, the term "blindness" in Table 1 comprises categories 3, 4 and 5 of Table 2 and the term "unqualified visual loss" in Table 1 comprises category 9 of Table 2. If the extent of the visual field is taken into account, people with a field no greater than 10^{o} but greater than 5^{o} around central fixation should be placed in category 3 of Table 2 and persons with a field no greater than 5^{o} around central fixation should be placed in category 4 of Table 2, even if the central acuity is not impaired.

Thus the term "low vision" includes people with a visual acuity that falls in the range less than 6/18 and greater than or equal to 3/60. The term "blindness" includes people that have a visual acuity that falls in the range less than 3/60 to no light perception. People with a visual field (peripheral vision) of less than 10 degrees are classified as blind, even if the central acuity is not impaired.

Table 1: WHO classification of blindness and low vision (http://www.who.int/classifications/apps/icd/icd10online/)

Classification	**Description of visual impairment category**
H 54 Blindness and low vision	Category 1 – 5
H 54.0 Blindness, both eyes	Visual impairment category 3, 4 and 5 in both eyes
H54.1 Blindness, one eye, low vision other eye	Visual impairment categories 3, 4, 5 in one eye, with categories 1 or 2 in the other eye
H54.2 Low vision, both eyes	Visual impairment categories 1 or 2 in both eyes
H54.3 Unqualified visual loss, both eyes	Visual impairment category 9 in both eyes
H54.4 Blindness, one eye	Visual impairment categories 3, 4, 5 in one eye (normal vision in other eye)
H54.5 Low vision, one eye	Visual impairment categories 1 or 2 in one eye (normal vision in other eye)
H54.6 Unqualified visual loss, one eye	Visual impairment category 9 in one eye (normal vision in other eye)
H54.7 Unspecified visual loss	Visual impairment category 9 NOS

Table 2: WHO definition of visual impairment categories (http://www.who.int/classifications/apps/icd/icd10online/)

Category of visual impairment	**Visual acuity with best possible correction**	
	Maximum less than	**Minimum equal to or better than**
1	6/18	6/60
	3/10 (0,3)	1/10 (0,1)
	20/70	20/200
2	6/60	3/60
	1/10 (0,1)	1/20 (0,05)
	20/200	20/400
3	3/60	1/60 (finger counting at 1 metre)
	1/20 (0,05)	1/50 (0,02)
	20/400	5/300 (20/1200)
4	1/60 (finger counting at 1 metre)	Light perception
	1/50 (0,02)	
	5/300	
5	No light perception	
9	Undetermined or unspecified	

When doing an accessibility study for visually impaired people the WHO classification can be used to explain and clarify participant selection. It then need to be clearly specified which classification applies to participants e.g. H 54.0 (blindness, both eyes) or H 54.2 (low vision, both eyes) in cases where it is important to select both blind and low vision participants (e.g. Kleynhans, 2009). Such participants would then require different strategies or assistive technologies to access the electronic resource(s). These also need to be acknowledged and clarified when reporting on such studies e.g. as was done by Kleynhans (2009).The literature indicates that most blind people use a screen reader for computer access and that most people with low vision use a screen magnifier for this purpose. There are however people who fall in the low vision category who prefer using a screen reader. It is for this reason that a number of authors use the type of assistive technology used as the basis for participant selection (Pernice and Nielsen 2001; Henry, 2007).

4.3 Models of disability

Apart from the WHO classification, it is also important to note different models of disability, that can be used to define disability and for explaining the relationship between impairment, disability and the environment. Such models also form the basis that underpins classification systems such as the WHO classification. According to Seale (2006, p.10) there are the individual (medical) model, the social model and the administrative model. The preceding definition of visual impairment is based on the medical model, which views disability as the result of impairment. The social model, however, views disability as the result of a limiting environment and not as the result of an individual impairment. Administrative models of disability are often used to assess whether a person qualifies for benefits for compensation.

Different models of disability may lead to different models and approaches to service provision (e.g. education and library services).

4.3.1 Individual models of disability

Individualistic models of disability are based on the assumption that individual physical, sensory or intellectual impairments are the direct cause of the problems and difficulties that people with disabilities experience (Seale, 2006, p.19).

The medical model of disability is an example of an individual model. This model of disability has been criticised, as it views disabled people as somehow lacking and unable to play a full role in society. It has an effect on policy, marginalising disabled people's needs (Dewsbury, Clarke and Randall, 2004, p.147). The medical model establishes a causal relation between individual impairment, seen as a departure from human normality, and disability, seen as restriction in abilities to perform tasks (Terzi 2004, p.142). Seale (2006, p.19) also highlights the fact that the medical model views disability in terms of disease processes, abnormality and personal tragedy. Disability is seen as a direct result of impairment. It is sometimes also referred to as the personal tragedy model (Kearney and Pryor, 2003, p.163) in which people are seen as victims of their impairment. The Charity Model of Disability also focuses on the personal or individual tragedy of disability and portrays people with disabilities as helpless and in need of care (Seale, 2006, p.19). A medical model approach can lead to services that are therapeutic in nature and that aim to adjust the individual with the disabling condition (Kearney and Pryor, 2004, p.163).

4.3.2 Social models of disability

According to Dewsbury *et al*. (2004, p.145) the social model has been dominant in researching and understanding disability in recent years. Terzi (2004, p.141) states that the social model of disability is central to current debates in disability studies, as well as to related perspectives on inclusive education. Both Dewsbury *et al*. (2004) and Terzi (2004) outline the major differences between the two predominant models of disability, namely the individual (medical) model and the social model. These authors provide a critique of the social model and highlight some of its underlying problems.

The social model defines impairment as lacking part or all of a limb, or having a defective limb, organ or mechanism of the body. Disability is the disadvantage or restriction of activity caused by a contemporary social organisation which takes no or little account of people who have physical impairments and thus excludes them from participation in the mainstream of social activities (Terzi, 2004, p.143). This model of disability focuses on the limitations that society and the environment place on individuals with impairments. These limitations – rather than the individual impairment – cause the individual to become disabled (Oliver, 2006, p.32). It repositions people with disabilities as citizens with rights (Dewsbury *et al*., 2004, p.145) and reminds us that the issues of inclusion are important moral issues (Terzi, 2004, p.156). The model can thus be significant in influencing educational perspectives on inclusion as well as the inclusiveness of LIS services. A social model approach can lead to services that are focussed on barrier removal in the environment (Seale, 2006, p.11).

4.3.3 Administrative models of disability

Administrative models usually relate to specific areas of life like education or employment. They are used to assess whether persons with a disability qualify for benefits or compensation. The associated definitions are written into legislation and nearly always focus on the person's impairment rather than the physical or social environment. These definitions are most often used by welfare and health professionals (Seale, 2006, p.10).

An administrative model approach can lead to services based on the view that people with disabilities cannot solve their problems independently and that they require help through the provision of specialist services. LIS involved in accessibility studies might need to note the medical as well as the social model.

4.4 CLASSIFICATION SYSTEMS

The medical and social models have influenced various systems of classification that have been developed in an attempt to define impairment and disability and the relationship between the two concepts (Seale, 2006, p.1).

The WHO International Classification of Impairment Disability and Handicap (ICIDH) were published in 1980. It addressed the concepts of impairment, disability and handicap and defined the relationships between these concepts. This classification was based on the theoretical framework of the medical or individual model (Terzi, 2004, p.142). According to the ICIDH impairment is any loss or abnormality of psychological, physiological, or anatomical structure or function. Disability is

considered as any restriction or lack (resulting from impairment) of ability to perform an activity in the manner or within the range considered normal for a human being. The WHO ICIDH further interprets handicap as a disadvantage for a given individual, resulting from impairment or disability, that limits or prevents the fulfilment of a role that is normal (depending on age, sex and social and cultural factors) for that individual (Terzi, 2004, p.142).

The WHO started to revise its ICIDH in the late nineties as a result of the influence of the social model of disability. The new classification was initially called ICIDH-2, but later became known as the International Classification of Functioning, Disability and Health (ICF) (Seale, 2006, p.12). The WHO (2002) also argues for a biopsychosocial model of disability to combine what is valid in both models (medical and social), without reducing the complex concept of disability to only one of its aspects. Such classification systems must be noted and acknowledged when seeking participants and when reporting.

From the preceding section it is clear that there is more to "visual impairment" than just brief reference to the term in studies of accessibility, and that it is essential to have a clear definition of "visual impairment" and the categories under consideration before embarking on an accessibility study for visually impaired people. This also applies to models and classification systems of disability.

4 CONCLUSION

The article pointed out the inadquate consideration of "visual impairment" and clear definitions thereof in the LIS literature and especially studies of accessibility and that it might impact on the selection of participants and thus also on the scope of findings. Considering the growth in electronic information and digital libraries it is imperative for librarians to note different definitions and categories of visual impairment and the importance this has in selecting participants in studies on accessibilty as well as in considering the assistive techology participants are using.

REFERENCES

Abu-Doush, I. et al. (2013), "Towards a more accessible e-government in Jordan: an evaluation study of visually impaired users and Web developers", *Behavior & Information Technology,* Vol. 32 No. 3, pp. 273-293.

American National Standards Institute/Human Factors and Ergonomics Society (ANSI/HFES) (2008), "ANSI/HFES 200 Human factors engineering of software user interfaces", available at: http://www.hfes.org/Publications/ProductDetail.aspx?ID=79 (accessed 9 October 2010)

Andronico, P., Buzzi, M., Castillo, C. and Leporini, B. (2006), "Improving search engine interfaces for blind users: a case study", *Universal Access in the Information Society*, Vol. 5 No. 1, pp. 23-40.

Atinmo, M.I. (2007), "Setting up a computerized catalog and distribution database of alternative format materials for blind and visually impaired persons in Nigeria", *Library Trends*, Vol. 55 No. 4, pp. 830-46.

Axtell, R. and Dixon, J.M. (2002), "Voyager 2000: a review of accessibility for persons with visual disabilities", *Library High Tech*, Vol. 20 No. 2, pp. 141-47.

Bayer, N.L. and Pappas, L. (2006), “Case history of blind testers of enterprise software”, *Technical Communication*, Vol. 53 No.1, pp. 32-8.

Beverley, C.A., Bath, P.A. & Barber, R. (2011), Health and social care information for visually-impaired people. *Aslib Proceedings: New Information Perspectives*, Vol. 63 No. 2-3, pp. 256-274.

Brazier, H. (2007), “The role and activities of the IFLA libraries for the blind section”, *Library Trends*, Vol. 55 No. 4, pp. 864-78.

Brophy, P. and Craven, J. (2007), “Web accessibility”, *Library Trends*, Vol. 55 No. 4, pp. 950-72.

Burrington, G.A. (2007), “A user's perspective”, *Library Trends*, Vol. 55 No. 4, pp. 760-66.

Byerley, S. L. and Chambers, M.B. (2002), "Accessibility and usability of web-based library databases for non-visual users", *Library Hi Tech*, Vol. 20 No. 2, pp. 169-78.

Byerley, S. L. and Chambers, M.B. (2003), "Accessibility of web-based library databases: the vendors’ perspectives", *Library Hi Tech*, Vol. 21 No. 3, pp. 347-57.

Carey, K. (2007), “The opportunities and challenges of the digital Age: a blind user's perspective”, *Library Trends*, Vol. 55 No. 4, pp. 767-84.

Chapman, A. (2007), “Resource discovery: catalogs, cataloging, and the user”, *Library Trends*, Vol. 55 No. 4, pp. 917-31.

Craven, J. (2001), “Understanding the searching process for visually impaired users of the Web”, *Ariadne*, Issue 26 January.

Cylke, F.K., Moodie, M.M. and Fistick, R.E. (2007), “Serving the blind and physically handicapped in the United States of America”, *Library Trends*, Vol. 55 No. 4, pp. 796-808.

Davies, J.E. (2007), “An overview of international research into the library and information needs of visually impaired people”, *Library Trends*, Vol. 55 No. 4, pp. 785-95.

Davis, J.J. (2003), “The accessibility divide: the visually-impaired and access to online news”, *Journal of Broadcasting & Electronic Media*, Vol. 47 No. 3, pp. 474-81.

Dewsbury, G., Clarke, K. and Randall, D. (2004), “The anti-social model of disability”, *Disability & Society*, Vol. 19 No. 2, pp. 145-58.

Elsebeth, T. and Frederiksen, C. (2007), “The DAISY standard: entering the global virtual library”, *Library Trends*, Vol. 55 No. 4, pp. 932-49.

Evett, L. and Brown, D. (2005), “Text formats and web design for visually impaired and dyslexic readers – Clear Text for All”, *Interacting with Computers*, Vol. 17 No. 4, pp. 453-72.

Fernandes, H. et al. (2012), “Providing accessibility to blind people using GIS”, *Universal Access in the Information Society*, Vol. 11 No. 4, pp. 399-407.

Guercio, A. et al. (2011), “Addressing challenges in web accessibility for the blind and visually impaired”, *International Journal of Distance Education and Technologies*, Vol. 9 No. 4, pp. 1-13.

Gulliksen, J. and Harker, S. (2004), “The software accessibility of human-computer interfaces: ISO Technical Specification 16071”, *Universal Access in the Information Society*, Vol. 3 No. 1, pp. 6-16.

Harper, S., Goble, C. and Stevens, R. (2005), “Augmenting the mobility of profoundly blind Web travelers”, *New Review of Hypermedia & Multimedia*, Vol. 11 No. 1, pp. 103-28.

Henry, S.T. (2007), “Just Ask: Integrating Accessibility Throughout Design”, Lulu.Com, available at: http://www.uiaccess.com/accessucd/ut_plan.html#characteristics (accessed 15 January 2008).

Hunsucker, R.L. (2013), “Making life easier for the visually impaired Web searcher: it is now clearer how this should and can be done, but implementation lags”, *Evidence Based Library & Information Practice*, Vol. 8 No. 1, pp. 90-93.

International Classification of Diseases (ICD 10), available at: http://www.int.classifications/icd/en/ (accessed 15 January 2008).

International Organisation for Standardisation (2003), “ISO/TS 16071:2003 - Ergonomics of human system interaction: guidance on accessibility for human computer interfaces”, available at: http://www.iso.org/iso/catalogue_detail.htm?csnumber=30858 (accessed 9 October 2010).

International Organisation for Standardisation (1998), “ISO 9241-11:1998 - Ergonomic requirements for office work with visual display terminals (VTDs) - Part 11: guidance on usability”, available at: http://www.iso.org/iso/catalogue_detail.htm?csnumber=16883 (accessed 9 October 2010)

Johnson, D. (2000), “E-books, libraries and access for the blind”, *Library Hi Tech News*, Vol. 17 No. 4.

Kearney, P.M. and Pryor, J. (2004), “The international classification of functioning, disability and health (ICF) and nursing”, *Journal of Advanced Nursing*, Vol. 46 No. 2, pp. 162-70.

Kleynhans, S.A. (2009). An accessibility evaluation of the Blackboard Vista learning system for visually impaired learners. Mini-dissertatio. Pretoria: University of Pretoria.

Kouroupetroglou, C., Salampasis, M. and Manitsaris, A. (2007), “Browsing shortcuts as a means to improve information seeking of blind people in the WWW”, *Universal Access in the Information Society*, Vol. 6 No. 3, pp. 273-83.

Lescher, J. and Ojala, M. (2000), “Designing web sites for the blind”, *eContent*, Vol. 23 No. 2, pp. 14-23.

Lewis, V. and Klauber, J. (2002), “[Image] [Image] [Image] [Link] [Link] [Link]: inaccessible Web design from the perspective of a blind librarian”, *Library Hi Tech*, Vol. 20 No. 2, pp. 137-40.

Murphy, E., Kuber, R., McAllister, G., Strain, P. and Yu, W. (2008), “An empirical investigation into the difficulties experienced by visually impaired Internet users”, *Universal Access in the Information Society*, Vol. 7 Nos 1/2, pp. 79-91.

Oliver, M. (1996), *Understanding Disability: from Theory to Practice*, Palgrave Press, Basingstoke.

Owen. D. (2007), “Sharing a vision to improve library services for visually impaired people in the United Kingdom”, *Library Trends*, Vol. 55 No. 4, pp. 809-29.

Pernice, K. and Nielsen, J. (2001), *Beyond ALT text: making the Web easy to use for users with disabilities*, Nielsen Norman Group, Fremont, CA, available at: http://www.nngroup.com/reports/accessibility/ (accessed 15 October 2008).

Rogers, M. and Rajkumar, T.M. (1999), ”Developing electronic commerce web sites for the visually impaired”, *Information Systems Management*, Vol. 16 No. 1, pp. 15-25.

Roos, J.W. (2007), “Libraries for the blind as accessible content publishers: copyright and related issues”, *Library Trends*, Vol. 55 No. 4, pp. 879-916.

Seale, J. (2006), *E-learning and Disability in Higher Education: Accessibility Theory and Practice*, Routledge, Oxford.

Sahib, N.G. (2012), “A comparative analysis of the information-seeking behaviour of visually impaired and sighted searchers”, *Journal of the American Society for Information Science and Technology*, Vol. 63 No. 2, pp. 377-391.

Stewart, R., Narendra, V. and Schmetzke, A. (2005), "Accessibility and usability of online library databases", *Library Hi Tech*, Vol. 23 No. 2, pp. 265-86.

Takagi, H., Saito, S., Fukuda, K. and Asakawa, C. (2007), “Analysis of navigability of web applications for improving blind usability”, *ACM Transactions on Computer-Human Interaction (TOCHI)*, Vol. 14 No. 3, pp. 1-37.

Tank, E. and Frederiksen, C. (2007), “The DAISY standard: entering the global virtual library”, *Library Trends*, Vol. 55 No. 4, pp. 932-49.

Terzi, L. (2004), “The social model of disability: a philosophical critique”, *Journal of Applied Philosophy*, Vol. 21 No. 2, pp. 141-58.

Tucker, R.N. (2007), “Library and resource center facilities for visually and print impaired people in developing countries”, *Library Trends*, Vol. 55 No. 4, pp. 847-63.

University of Bristol, Library and Computing Services (2008), “About web accessibility”, available at: http://www.bristol.ac.uk/is/info/websupport/accessibility/about-web-accessibility.html (accessed 15 January 2008).

Valenza, J.K. (2000), “Surfing Blind”, *Library Journal*, Vol. 125 No. 14, pp. 34-6.

Van der Heiden, G.C. (1996), “Universal design: what it is and what it isn’t”, available at: http://trace.wisc.edu/docs/whats_ud/whats_ud.htm (accessed 15 December 2008).

Venter, S. and Lotriet, H. (2005), “Accessibility of South African web sites to visually disabled users”, *South African Journal of Information Management*, Vol. 7 No. 2, pp. 13-25.

Walsh, J. (2006), “Improving Web Accessibility for the Visually Impaired”, *Library Hi Tech News*, Vol. 23 No. 8, pp. 29-31.

World Health Organisation (2007), “International Classification of Diseases (ICD)”, available at: http://www.who.int/classifications/icd/en/ (accessed 15 January 2008).

World Health Organisation (2007), “International Statistical Classification of Diseases and Related Health Problems” 10th Revision, Version for 2007, available at: http://apps.who.int/classifications/apps/icd/icd10online/ (accessed 15 January 2008).

World Health Organisation (2002), “The World Health Report 2002- Reducing Risks, Promoting Health Life”, available at: http://www.who.int/whr/2002/en/ (accessed 15 January 2008).

Yang, Y-F., Hwang, S-L. & Schenkman, B. (2012), “An improved Web search engine for visually impaired users”, *Universal Access in the Information Society*, Vol. 11 No. 2, pp. 113-124.

Xiaoyu, C., Tremaine, M., Lutz, R., Jae-woo, C. and Lacsina, P. (2006), “Audio Browser: a mobile browsable information access for the visually impaired”, *Universal Access in the Information Society*, Vol. 5 No. 1, pp. 4-22.