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Abstract

Digital libraries, designed to serve people and their information needs in the same way as traditional libraries, present distinct advantages over brick and mortar facilities: elimination of physical boundaries, round-the-clock access to information, multiple access points, networking abilities, and extended search functions. As a result, they should be especially well-suited for the disadvantaged. However, minorities, those affected by lower income and education status, persons living in rural areas, the physically disabled, and developing countries as a whole consistently suffer from a lack of accessibility to digital libraries.

This paper evaluates the effectiveness and relevance of digital libraries currently in place and discusses what could and should be done to improve accessibility to digital libraries for the disadvantaged.

Introduction

For the purposes of this paper, the term "disadvantaged" encompasses traditional minorities (African Americans, Hispanics, and Native Americans), persons with lower levels of income and education, those living in rural areas, the physically disabled, as well as developing countries as a whole. Definitions of the term vary; in the socio-cultural context, to be "disadvantaged" is to be "deprived of some of the basic necessities or advantages of life, such as adequate housing, medical care, or educational facilities" (answers.com, 2010). When one is counted among the disadvantaged, one is a member of "deprived people considered as a group" (answers.com, 2010). It is encouraging to see the inclusion of "educational facilities" among the basic necessities needed to provide improved quality of life. Nonetheless, ongoing issues such as inequality and lack of efficiency result, according to statistics presented during the Model United Nations Far West's 47th agenda, in approximately one billion people worldwide going through life without access to education, including 300 million children (MUNFW, 1997).

When considering how the library and information science profession might help change these discouraging figures, it is logical to conclude that digital libraries, as the "digital face of traditional libraries" with an ability to serve "particular communities or constituencies" even when those are "widely dispersed throughout the network" (IFLA, 1998), should make for a good choice. Indeed, in the late 1980s and early 1990s, with the advent of the Internet and the World Wide Web, new avenues for the dissemination of information rapidly emerged (Wikipedia, 2010). When computers became increasingly commonplace, access to information evolved from being restricted to physical space to being made available via remote access (ibid). In the late 1990s, aided by the fast growth of "computing networks, databases, and public awareness" (Borgman, 1990, 229), "scholarly and professional interest in digital libraries" grew rapidly, and large amounts of research funding were made available, quickly resulting in "research and practice in digital libraries exploding worldwide" (Borgman, 1990, 227). However, digital libraries did not become the instantaneous success many imagined them to be despite their ability to provide users with significant advantages such as the elimination of physical boundaries, round-the-clock access to information, multiple access points, networking abilities, and extended search functions (LisWiki, 2010). Subsequent research revealed that user acceptance of digital libraries primarily revolves around user-friendliness, ease of use, usefulness, and various other factors falling into categories such as interface characteristics, organizational context, and individual differences (Thong, et al., 2004). These expectations are largely the same for all users, regardless of the individuals' information technology background (Zabihi, et al., 2006). Where usability is concerned, it was found that "there exists an interlocking relationship among effectiveness, efficiency, satisfaction, and learnability [*sic*]" (Jeng, 2005, 47). While undeniably valuable, many of these research efforts centered on the academic community and involved users equipped with ready access to electronic information technologies, leaving out special needs considerations and raising the question as to whether the above-described user expectations apply equally well to different groups of the disadvantaged.

It is the purpose of this paper to examine the state of accessibility to digital libraries for traditional minorities, persons of lower income and education status, and those living in rural areas, for the physically disabled, and for developing countries as a whole. Analysis includes description of tools currently in place, discussion of their

effectiveness and relevance, and what might be done to further improve accessibility to digital libraries for the disadvantaged.

Literature Review

Much of the literature discussing issues of accessibility to electronic information and communication systems for minorities, those affected by lower income and education status, and persons living in rural settings, addresses one or more aspects of the *digital divide*, but rarely includes the role of digital libraries and the relevance of their content for these disadvantaged. Common in the articles and books reviewed is the discussion of the causes of the *digital divide*, as well as the effort to find solutions for bridging the widening and deepening gap between those who have access to electronic information technologies and those who do not (Chowdhury, 2002; Dijk, 2005; Gates Foundation, 2004; Tedd and Large, 2005). In the United States, primary reasons preventing user access to electronic information systems have been identified as lack of appropriate technologies, information technology illiteracy, and language barriers (Tedd and Large, 2005), as well as fear of steep learning curves, and reluctance to ask for assistance (Gates Foundation, 2004). Solutions include the increase of accessibility to public computer stations and the provision of free-of-charge workshops on how to efficiently use computers and the Internet (Chowdhury, 2002; Dijk, 2005; Gates Foundation, 2004; United States Senate Hearing 107-1097, 2002). These services are often the only means for minorities, the poor, the uneducated, and those living in rural settings, to gain access to electronic information and communication technologies, and are currently offered almost exclusively by public libraries, placing a heavy burden on these institutions (Gates Foundation, 2004).

Literature describing issues of accessibility to electronic information and communication systems for the physically handicapped centers on physical access in much the same fashion as do the writings on the disadvantaged groups addressed in the previous paragraph. Digital libraries and their relevance are often mentioned only in passing, if at all. Disabled persons in many countries, by means of legislation, are now provided with the same rights to access to electronic information and communication systems as those who are without disabilities (Mates, 2010; Tedd and Large, 2005). As a result, libraries offering access to computers and the Internet for their patrons have been equipped with screen readers and reading software for persons with visual and cognitive impairments, as well as with specialized workstations for those with other physical handicaps (Mates, 2010; Tedd and Large, 2005). Where remote access to library content is concerned, for the blind several programs are in place that provide free of charge access to current literature and materials in the public domain. However, not all databases are encoded in a manner that is suitable for the blind and visually impaired (Mates, 2010; Tedd and Large, 2005; SLA Info News, 2010). Currently, half of all persons with disabilities - who taken together constitute the largest and most diverse minority in the United States - are unemployed and/or unable to fulfill their goals of higher education (Mates, 2010). To increase the likelihood for the blind and visually impaired to find employment or succeed in obtaining degrees of higher education, libraries must include a wider selection of non-fiction and reference books (Craven, 2001). To ensure truly equal access to electronic information and communication systems for this group of the

disadvantaged, relevant materials must also be made available in a larger variety of electronic formats (ibid).

Literature addressing issues of accessibility to digital libraries for persons living in developing countries is manifold and provides in-depth discussion of the topic. For developing nations, the greatest barrier to both the establishment and provision of continuous access to digital libraries is the ongoing struggle to meet, on a daily basis, the basic human needs for entire populations, an effort so pervasive as to leave no resources to cover the high cost involved in the creation and maintenance of digital libraries (Chowdhury, 2002; Rosa and Lamas, 2007). Additional difficulties include insufficient, restricted, or nonexistent Internet connectivity, lack of suitable technologies, absence of trained manpower, high levels of information illiteracy, as well as a widespread disinterest of the greater population in electronic information and communication services and their uses (Chowdhury, 2002; Witten, 2004; Worcman, 2002). Despite the manifold obstacles in place, various projects are currently underway to provide developing countries with suitable digital libraries. Among those most successful is the *Greenstone* digital library system, an open-source, multi-lingual software suite designed to run on outdated computer software and hardware (Chowdhury, 2002; Greenstone, 2007; Witten, 2004; Worcman, 2002). Care is taken to customize digital libraries for developing countries with information that is helpful to "reduce poverty, increase human potential, and give a useful education" (Witten, 2004, 965). To further enhance relevance of content, the majority of digital libraries designed for developing nations include the ability to add "collections of locally produced information" (Chowdhury, 2002, 385), a feature that provides unique opportunities for otherwise uninvolved members of this vast group of the disadvantaged to participate in the process of recording and storing, in their own words, the histories of their families, communities, and the country at large (Chowdhury, 2002; Worcman, 2002).

Discussion

Accessibility to Digital Libraries for Minorities, Persons of Lower Income and Education Status, and Those Living in Rural Areas

"At the end of the 1990s, the issue of the so-called digital divide was suddenly put on the agenda of public, political, and scholarly debate, starting in the United States and spreading to Europe and the rest of the world" (Dijk, 2005, 1). Definitions of what is the *digital divide* vary according to context. In its broadest sense, the concept describes the gap between persons or groups who have access to computers and the Internet, and those who do not (Dijk, 2005). More specifically, the *digital divide* is understood to be the "current substantial disparity between industrialized and developing countries or even within the same country with regard to the access and usage of information and communication technology" (Rosa & Lamas, 2007, 411). While spontaneous reaction may lead to the conclusion that the majority of those affected by the *digital divide* live in developing countries, statistics prove otherwise: "in the Fall of 2000, the US Department of Commerce found that only 41.5% of all US homes had Internet access" and in Great Britain, "more than 60 percent of the richest ten percent of the population have household access to the Internet, whereas among the poorest ten percent, only six percent have

household access to the Internet" (Chowdhury, 2002, 380). In the United States, those hit hardest by the effects of the *digital divide* include traditional minorities (persons of African American, Hispanic, and Native American descend), those with lower income and education levels, and persons living in rural communities (Gates Foundation, 2004). For these disadvantaged, barriers to access to digital libraries exist on multiple levels, with some of the most important being lack of Internet connectivity, high cost of computer equipment and Internet access fees, lack of basic computing skills, varying levels of illiteracy, language barriers, as well as lack of motivation and overall absence of reason to use computers or the Internet (Dijk, 2005). For many of those who are interested in the use of electronic information technologies, fear of steep learning curves and the need to ask for help present additional, sociological, barriers (Gates Foundation, 2004).

In the U.S., libraries have been assigned the task of trying to bridge the gap caused by the *digital divide*; as a result of government programs and extensive private funding, nearly 95% of all libraries in North America are equipped with computer stations allowing for public access to the Internet and digital libraries free of charge, a service used daily by more than 14 million persons, or roughly 10% of all Internet users (Gates Foundation, 2004). Extensive research has brought to light a number of substantial benefits gained by this development. Computers in public libraries reach disadvantaged groups who consistently suffer from lack of access and information technology skills; serve as learning tools for basic computer and Internet skills; help individuals to find jobs, complete homework assignments, retrieve relevant information; and constitute the primary electronic information and communication hub for persons living in rural settings where Internet connectivity at home is unobtainable due to lack of availability or high cost (ibid). The very same research efforts also revealed that while libraries clearly are at the forefront of bridging the *digital divide*, they are nonetheless constantly confronted with major challenges, such as funding cuts resulting in reduction of library staff, decrease in services, and fewer opening hours - issues which threaten regular access to electronic information technologies for disadvantaged patrons (ibid).

While such studies showcase well the importance of libraries in improving accessibility to electronic resources for those who are at a disadvantage because of their minority status, lower income and education levels, or residence in rural areas, they rarely address the role of digital libraries and their degree of relevance for these user groups. According to Marchionini, Plaisant, and Komlodi "digital libraries are the logical extensions and augmentations of physical libraries in the electronic information society. Extensions amplify existing resources and services and augmentations enable new kinds of human problem solving and expression. As such, digital libraries offer new levels of access to broader audiences […]" (Marchionini, Plaisant, & Komlodi, 2003, 3). How, if at all, do these ideals translate to the reality of the disadvantaged?

Drawing on insights gained from both the consistent use of digital libraries and databases during her undergraduate and graduate studies, and the various positions held as a student assistant in a combined public and university library, the author of this paper has come to the conclusion that much of the content of the *vendor-driven* digital libraries offered by her city's network of libraries is irrelevant to the immediate needs of the disadvantaged discussed in this segment. Peer-reviewed journals and subject-specific databases, many of which require extensive knowledge on how to construct effective

searches, are not helpful in providing pertinent information on how to improve reading, writing, and language skills; gain basic computing knowledge; find employment; and use the Internet as an effective communication tool. This author's observations appear to have been shared by the library management. A recent restructuring of the library network's online presence led to the inclusion of a number of smaller, specialized digital libraries, designed to offer content such as described above. Disadvantaged patrons can now access an extensive array of services via well-structured and easy-to-access web pages and there find relevant information poised to fulfill many immediate user needs.

These changes to both the structure and content of this library network's digital libraries are promising and much-needed steps in the right direction and serve to encourage libraries across the nation who have not yet taken these steps to follow suit. However, to be able to continue on this path, libraries must receive the continuous support of lawmakers and their communities (Gates Foundation, 2004). Without adequate funding, libraries can neither uphold the cost associated with the maintenance of public computer stations (ibid), nor offer remote access to databases and digital libraries. If as a result of lack of funding, libraries are ultimately forced to cease the various programs, which currently help narrow the *digital divide,* for many of the disadvantaged this will result in the loss of their sole opportunity to learn about, access, and use electronic information and communication technologies.

With the burden of improving accessibility to electronic information and communication technologies for certain disadvantaged groups squarely placed on the shoulders of libraries, their constantly struggle to obtain and maintain funding, and the profound lack of alternative and/or additional institutions aiding in the ongoing effort, the question of "are all Americans going to have access to those technologies or, in fact, are we going to leave millions of Americans, people in rural areas, minorities, people in the inner city, behind, and deny them the opportunity to enjoy the fruits of the technological revolution?" (United States Senate Hearing 107-1097, 2002, 2) remains unanswered to this day.

Accessibility to Digital Libraries for Persons with Physical Disabilities

"Ensuring equal access to information for all, which is indispensable to the establishment of the information society, also refers to groups of people with special needs and disabilities" (Golub, 2004, 1). When the *Americans with Disability Act* (ADA) was signed into law in 1990, affording disabled persons the same rights as individuals without disabilities, it was greeted as a major step towards equal access to information for the disadvantaged; however, despite major efforts on all fronts and the fact that disabled persons are the most diverse amongst all minority groups (Mates, 2010), "approximately half of this country's disabled workforce is unemployed and higher education for many disabled individuals is still just a dream" (Mates, 2010, 41).

Where libraries are concerned many steps have been taken to provide disabled persons with access to digital libraries while they are visiting traditional brick and mortar facilities: screen readers and reading software for persons with visual and cognitive impairments have been installed; suitable workstations with larger monitors, adjustable desks and chairs, trackball-mice and larger keyboards have become commonplace; and training sessions for library personnel on how to effectively communicate with members

of the disabled persons community in accord with the ALA's *Association of Specialized and Cooperative Library Agencies* (ASCLA) are on most libraries' personnel advancement calendars (Mates, 2010; Tedd and Large, 2005).

But is not one of the main goals of digital libraries to provide *remote access* to information, thus making it a perfect tool for the disabled population to garner knowledge from the comfort of their own home? Two large-scale programs fulfilling these criteria are currently in place. The Library of Congress*' National Library Service for the Blind and Physically Handicapped* (NLS) issues encrypted code keys to qualified users, enabling them to access "modern books" from anywhere (SLA Info News, 2010), and the *Internet Archive* provides unencrypted access to materials in the public domain via DAISY, a specialized digitization format designed for the blind and persons with other forms of disabilities (ibid).

While these programs are a definitive step in the right direction of providing access to digital libraries for this group of the disadvantaged, differing standards applied during the encoding of many other databases and websites prevent the same level of equality of access. As an example, if graphic content contained within a web page is not sufficiently described in the text, a blind reader is likely to miss important portions of the reading's overall context (Mates, 2010). It is especially discouraging to see that such inequality of access still exists when taking into consideration that the "access for all" standards established by the World Wide Web Consortium (W3C) merely consist of properly marked-up HTML code, which does not require additional expense or training (Mates, 2010). Regardless of these perks, many business and personal websites to this day simply ignore the W3C best practices – but can they really be faulted when even prominent online database providers do not yet offer their costly products in an "access for all" format (ibid)?

Such lassitude by providers presents unnecessary barriers to equal access to digital libraries and removes those already at a disadvantage even further from gaining access to basic needs. Steps are now being taken to resolve above-discussed issues; in some states, the concept of accessibility has been signed into law for certain types of websites (prominent examples are government websites and the California State University system) and is now regulated by section 508 of the *United States Accessibility Board* (United States Accessibility Board, 2010).

While such developments certainly further the cause of access to information for disabled persons, the concept of accessibility goes beyond the physical means of access; a looming question asks how relevant the content of digital libraries and the services offered by libraries truly are to persons with disabilities. Jenny Craven (2001) suggests that in order to provide genuinely equal access to information it is necessary for libraries to include a much larger selection of non-fiction and reference books for the blind and visually impaired in order to increase the likelihood for these disadvantaged groups to find employment and/or take advantage of career advancement opportunities within their chosen professions. In addition, so Craven states, these materials should be presented in a variety of formats, such as text documents that are web-based and include links to other resources, as well as reference databases, which are commercially licensed rather than bought and thus remotely accessible from anywhere via specially formatted links from the library's website (Craven, 2001). The latter is a necessity resulting from the fact that currently "in some countries there are over a hundred producers of accessible formats"

(Golub, 2004, 4). While Craven's suggestions present respectable short-term solutions, the efficient, relevant, and essential future digital library for the physically disadvantaged should be based on collaboration and international sharing of information resources with union catalogs of accessible formats that are cross searchable at the international level (Golub, 2004). To this end, several project are underway, such as the European Union's TESTLAB (Testing Electronic Systems using Telematics for Library Access for the Blind) with its aim of "building a central catalog of accessible library materials and adapting existing OPACS for blind users" (Golub, 2004, 4); several large online national catalogs of accessible formats created by the United Kingdom, Canada, New Zealand, and the United States; and MIRACLE (Music Information Resources Assisted Computer Library Exchange), a European project aimed at providing blind musicians with a central catalog of Braille music stores (Golub, 2004). Once again, these concerted efforts are encouraging advancements. However, many projects find themselves prohibited from including relevant materials and new publications due to these materials' copyright protection status (ibid). Some of the projects have addressed this by "producing digital text formats solely for the blind and visually impaired," and by "restricting access to the blind members in order to ensure copyright protection, since producing adjusted formats for people with disabilities is usually understood as fair use" (Golub, 2004, 4). Yet, many publishers are reluctant to provide digital copies of print works, citing the ease of copying and distribution of electronic materials as their reasons to decline (Golub, 2004).

The discussion of a few of the most pressing concerns has shown that the creation and maintenance of digital libraries, which provide equal access to relevant, essential, and current materials for the disabled, is a difficult and complex undertaking. Past and current digital library projects set milestones in their efforts to lessen - and ultimately end - the exclusion of the physically handicapped from these important parts of the national and international information society. However, many ideas currently remain unrealized due to lack of collaboration, interest, or funding; differing standards and access formats; issues involving intellectual property rights; and government regulations which are limited to certain institutions and online content only.

In addition, careful consideration must be given to how digital libraries for the physically handicapped are being made available as they must be compatible with the requirements of the oftentimes highly specialized, individualized, and costly devices that enable this group of the disadvantaged to access electronic content in the first place.

Accessibility to Digital Libraries for Persons Living in Developing Countries

In countries considered developing, accessibility to digital libraries – or any type of library – is often a matter of secondary concern. Faced with the ongoing struggle of having to secure food, drinking water, health care (Rosa and Lamas, 2007), sanitation, transportation, and electricity (Chowdhury, 2002) for their populations, "developing countries, especially the least developed countries, that struggle to meet the basic human needs, cannot afford to spend such huge amounts of money required for research and development of digital libraries" (Chowdhury, 2002, 380). Next to the high cost of building and maintaining digital libraries a second major problem consists of Internet connectivity being insufficient or even nonexistent (Witten, 2004). As a result, the majority of people living in developing countries are entirely without access to computers and the Internet and are thus by default excluded from information that is disseminated electronically (Chowdhury, 2002; Worcman, 2002). In areas with established

connectivity matters are further complicated by a consistent lack of suitable technologies (for example, outdated hardware or incompatible software), absence of trained manpower (Witten, 2004), and high levels of information illiteracy - the latter being one of the primary causes of a widespread disinterest in electronic information services and their uses (Chowdhury, 2002).

While taken together these deficiencies seem like insurmountable obstacles to bringing digital libraries to developing countries and subsequently granting access to information for the larger population, quite the opposite is true. Ongoing exchanges of ideas and several projects in progress present a number of solutions poised to succeed. As discussed above, one of the major hindrances to access to digital libraries is a widespread lack of access to the Internet. But even where web access is available, connectivity is likely to be slow, spotty, or restricted to certain areas. Where such is the case, it is imperative that digital library systems be able to be run locally rather than as a part of a centralized network (Witten, 2004). Of equal importance is the fact that digital library software is likely to be run on a variety of low end and/or outdated computer systems (ibid). A prominent example of a digital library system, which aims to incorporate solutions to many of these pervasive problems, is the *Greenstone* digital library software. This open-source, multi-lingual software suite, the purpose of which is to aid in the building and distribution of digital library collections, is "produced by the *New Zealand Digital Library Project* at the University of Waikato and developed and distributed in cooperation with UNESCO and the Human Info NGO" (Greenstone, 2007). It is currently "distributed widely in developing countries with the aim to empower users, particularly in universities, libraries, and other public service institutions, to build their own digital libraries" (Witten, 2004, 966).

Keeping in mind the difficulties developing countries face with regards to information and communication technologies, the core of the *Greenstone* digital library software is designed to run on Unix, Windows, and Mac operating systems and is backwards compatible starting with Windows 3.1 (Witten, 2004). The collections stored on the *Greenstone* digital library server are accessible via the Internet or "presented as stand-alone libraries on removable media such as CD-ROM" (Witten, 2004, 966). Furthermore, "any *Greenstone* collection can be converted into a self-contained Windows CD-ROM that includes the *Greenstone* server software itself and an integrated installation package" (ibid). Aside from the important factors of being multilingual, easy to install, and cross-platform compatible, one of the major advantages of the *Greenstone* software suite is the fact that it is designed to encourage users in developing countries to build and distribute their own digital library collections rather than to solely utilize those originating in the developed world (Witten, 2004). This approach allows developing countries to play an active role in the creation of a worldwide information society instead of observing it as outsiders (ibid) and presents an opportunity to create digital libraries enriched with information relevant to its users. These customized libraries may, for example, include practical information on the basic needs of daily life, and lead to the inclusion of compendiums such as the *Human Development Library*, which aims to "reduce poverty, increase human potential, and give a useful education" (Witten, 2004, 965), the *UNAIDS Library,* with its "mission to lead, strengthen and support a response to the AIDS epidemic that will prevent the spread of HIV" (ibid), or the *Health Library for Disasters*, which contains "over 300 technical and scientific documents on disaster

reduction and public health issues related to emergencies and humanitarian assistance" (Witten, 2004, 966). In addition to the ability of including customized vital humanitarian and disaster relief information into a modular digital library such as *Greenstone*, immediate relevance of content might be further enhanced with the addition of collections of primary sources about the country, its people, culture, and customs. This is of special importance when considering that throughout much of history the description of developing countries and their cultures often excluded active involvement of the communities in question, resulting in the "colonization and appropriation of a group's culture" (Worcman, 2002, 3) by outsiders rather than providing an accurate representation drawn by insiders. Including customized socio-cultural content into digital libraries provides developing nations with the unique opportunity for first-hand "preservation and propagation of indigenous culture" and to "build collections of locally produced information" (Chowdhury, 2002, 385). The production of such locally relevant content encourages communities to collaborate in the research and description of culture and customs, and to find common denominators for the recording and storing of their history.

Giving persons who are not familiar with the use of textual materials, as well as those who cannot or do not wish to read or write, the opportunity to record their stories as oral or pictorial histories leads to the social integration of more members of the various communities. Furthermore, it presents an opportunity to broaden people's horizons via research, to gain a "new awareness of the world" (Worcman, 2002, 4), and to make computer technologies and their applications meaningful and useful (Worcman, 2002), the latter of which may in turn contribute to a lessening of the general disinterest in computers and electronic information services, a pervasive problem described by Chowdhury (2002).

Undeniably, developing countries are facing many challenges in their efforts of bridging the *digital divide*; however, so Ian Witten (2004) observes, "it sometimes happens that technological advances in developing countries leapfrog those in developed ones. This occurs because established infrastructure, a strong and necessarily conservative force, is absent" (Witten, 2004, 962). With projects such as the *Greenstone* digital library software, customizable databases and compendiums distributed by UNESCO and non-governmental organizations, the ability to easily create, store, and distribute relevant socio-cultural content according to availability of technologies, and an ever-spreading awareness of the plight of developing countries, there is concrete evidence of efforts being made to narrow the chasm that separates the information rich from the information poor. Nonetheless, much more needs to be done to ensure that developing nations are included in a future where the creation and dissemination of information is likely dominated by electronic technologies.

Conclusion

While discussions revolving around usability and accessibility to digital libraries and online databases have been ongoing for more than ten years, it is apparent that solutions to issues of accessibility to digital libraries for the disadvantaged are still in their infancy. For minorities, those affected by lower income and education status, as well as for persons living in rural communities, a major hindrance to furthering the cause of

digital libraries appears to be the "long-standing three-way tension between commercial interests of publishers, the need of society and information users, and the social mandate of public libraries" (Witten, 2004, 963). For the physically disabled, varying standards, differing needs for those affected, and the reluctance of creators of databases, websites, and programs to employ "access for all" standards even when these are readily available, are pervasive problems that consistently prevent universal access. Where developing countries are concerned, major obstacles to universal access to digital libraries are high-cost issues such as lack of Internet connectivity and outdated or incompatible technologies, as well as lack of trained manpower, and general disinterest in electronic information technologies (Chowdhury, 2002).

It thus appears that the digital libraries community as a whole has a long way to travel on the road of providing universal access. As Witten (2004) summarizes, universal access means that digital libraries must be designed to educate their users according to their abilities and capabilities; are multi-lingual in design; make available their content as textual and non-textual materials; run on low-end devices; and refrain from "providing a lowest-common denominator solution that sacrifices high-end capability where it is available" (Witten, 2004, 967). On the upside of this list of deficiencies, steps are taken to remedy what is lacking, awareness is spreading, and technology in every sector is advancing in leaps and bounds, helping to create new avenues for accessibility. Taken together, these developments provide hope for a better future not only for the disadvantaged but for humankind as a whole who will gain invaluable insight and unique knowledge from a portion of the population that is, despite having been labeled "disadvantaged," no less capable of adding outstanding contributions.

In sum, access to information is an essential necessity for all but especially so for those considered disadvantaged. With this in mind, the digital libraries community must continue to strive to create as many access points as possible for those who are in need of the extra effort that will prevent them from becoming disadvantaged in the first place.

References

Answers.com (2010). *Disadvantaged.* Retrieved July 16, 2012 from http://www.answers.com/topic/disadvantaged

Borgman, C. (1999). What are digital libraries? Competing visions. *Information Processing and Management*, *35*(1999) 227-243.

Chowdhury, G. G. (2002). Digital divide: how can digital libraries bridge the gap? *Digital Libraries: people, knowledge and technology – 5th International Conference on Asian Digital Libraries,* Singapore, 379-391.

Dijk, J. A. G. M. van (2005). The deepening divide: inequality in the information society. Thousand Oaks, CA; Sage.

Gates Foundation (2004). *Toward equality of access: the role of public libraries in addressing the digital divide*. Retrieved July 14, 2012, from http://www.imls.gov/assets/1/AssetManager/Equality.pdf

Golub, K. (2002). Digital libraries and the blind and visually impaired. *Proceedings 4th CARNet Users Conference - CUC, Zagreb (Croatia).*

Greenstone (2007). *About Greenstone.* Retrieved July 15, 2012, from http://www.greenstone.org/

Jeng, J. (2005). What is usability in the context of the digital library and how can it be measured? *Information Technology and Libraries, 24*(2), 47-56.

Kani-Zabihi, E., Ghinea, G., & Chen, S. Y. (2006). Digital libraries: what do users want? *Online Information* Review*, 30*(4), 395-412.

LisWiki (2010). *Digital library.* Retrieved July 18, 2012, from http://liswiki.org/wiki/Digital_library#Advantages_of_the_Digital_Library

Marchionini, G., Plaisant, C., & Komlodi, A. (2003). The people in digital libraries: multifaceted approaches to assessing needs and impact. *Digital Library Use: Social Practice in Design and Evaluation*. Cambridge, MA: MIT.

Mates, B. T. (2010). Assistive technologies. *American Libraries, 41*(10), 40-42.

MUNFW (1997). Access to education. *Model United Nations Far West, 47th Agenda*. Retrieved July 17, 2012, from http://www.munfw.org/archive/47th/3rd2.htm

Rosa, I. B. & Lamas, D. R. (2007). Digital library for digital divide and environment of scarce access to printed materials: The case of University Jean Piaget of Cap Verde. *IADES International Conference e-Society 2007*, 411-414.

Ted, L. A., & Large, A. (2005). *Digital libraries: Principle and practice in a global environment.* Munich, Germany: K. G. Saur.

Thong, Y. L., Hong, W., & Tam, K. Y. (2004). What leads to user acceptance of digital libraries? *Communications of the ACM*, *47*(11), 79-83.

United States Accessibility Board (2010). *Section 508 homepage: electronic and information technology.* Retrieved July 15, 2012, from http://www.accessboard.gov/508.htm

United States Senate Hearing 107-1097 (2002). S. 414, digital divide and minority serving institutions. *Hearing Before the Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation.* United States Senate, One Hundred Seventh Congress, Second Session, February 27, 2002.

Wikipedia (2010). *Internet.* Retrieved July 15, 2012, from http://en.wikipedia.org/wiki/Internet

Witten, I. H. (2004). Digital library futuristics: Developing countries, universal access, and information for all. *Proc International Conference on Digital Libraries, vol 2,* New Delhi, 962-968.

Worcman, K. (2002). Digital division is cultural exclusion. But is digital inclusion cultural inclusion? *D-Lib Magazine,* March 2002, *8*(3).