

Comparing Accessibility of Learning Management and Library Management Systems for Students With Disabilities in the United States, China, and Nigeria

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This paper describes a research project designed to investigate major differences in accessibility to learning technologies in three of the world's largest countries in terms of population: United States, People's Republic of China, and Federal Republic of Nigeria. Each of these countries has unique social, economic, and political conditions that add value to the comparison conducted. As the researchers believe libraries serve an important role in the education of the public, both accessibility in school/university environments' and within public, school, and academic libraries' technologies were examined.

Research Problem

Little is known about the current state of accessibility for education on an International scale. Many studies that examine accessibility focus on a single institution or nation, lacking valuable comparative case study that informs readers and education professionals as to what practical measures can be taken to improve accessibility. By examining what some countries do right as well as identifying their weaknesses, professionals from these nations can work together to mutually support the improvement in accessibility. By identifying potential barriers to the diffusion and adoption of accessibility policy, professionals may work to ameliorate these barriers and create more equitable experiences for all learners.

Theoretical Lens for Analysis of Discrepancies in Accessibility Across Nations

The theoretical framework through which the researchers critically examined the gaps in accessibility across nations is based on Diffusion theory, most famously associated with the work of Everett Rogers (2010). This theory is commonly used to describe how discrepancies in the adoption of innovations occur (Lund, 2019). In the case of accessibility for educational systems, diffusion likely plays a major role, as the technologies used to support accessibility are generally free but information about the accessibility technologies and design are more restricted. Diffusion theory, and particularly supporting diffusion of information about accessibility, is suggested by the authors as one means to address the research problem identified above.

Description of the Countries Studied

The United States is the largest economic power in the world, with a Gross Domestic Product (GDP) of approximately \$20.5 trillion US in 2018 (World Book, 2019). Its population is around 325 million (3rd largest worldwide). It is a federal democratic republic, headed by an openly elected President and a Congress comprised on 535 members, with 50 states that each have their own governor and congress to legislate matters not under the purview of the federal government. Virtually all inhabitants descend from non-natives of the land, with white (77%), black (13%), and Asian (6%) being the largest ethnic groups. Political and social strife and funding for education and healthcare are often seen as major concerns within the country.

The People's Republic of China is the world's second largest economic power, with a GDP of approximately \$14 trillion US (World Bank, 2019). GDP per capita, however, is much lower in China, as it has the world's largest population at 1.5 billion. Officially, China is a one-party socialist republic, headed by the Communist Party of China. The federal government holds most of the power for governance of the nation. There are

over 50 officially-recognized ethnic groups in China, most all of which – including the largest ethnic group, Han, representing over 90% of China’s population – are native to the land. Some groups have emigrated from Japan, Vietnam, Korea, and India. A very small segment of the population originate from Europe, Australia, Africa, or the Americas. Suppression of certain political, religious, and social groups has, at times, been a concern within the country, as is the nation’s ability to adapt to its emerging role as an economic and higher education power.

The Federal Republic of Nigeria is the world’s 31st largest economic power, with a GDP of almost \$400 billion US (World Bank, 2019). Currently, its population is just over 200 million, making it the 7th largest nation by population. After being a British colony for the first half of the 20th century and then run by military dictatorships for most of the second half, the nation finally achieved a stable democracy in 1999 and is now run as a federal presidential republic (not too dissimilar from the United States). Virtually all inhabitants of Nigeria are native to the land, although there are over 200 distinct ethnic groups recognized by the nation. Due to its status as a British colony in the early and mid-1900s, the official language of the country is English (though over 500 different native languages exist). Religion plays an important part of Nigerian culture, with the nation split virtually evenly between Christians (generally in the south) and Muslims (in the north). This has led to some social and political divide. Healthcare, access to information, and violence (particularly from terrorists groups like Boko Haram) are all major concerns for many within the country.

Review of Prior Research on this Subject

Jaeger (2012), Coleman and Berge (2018), and 3PlayMedia (2016) provide overviews of literature pertaining to accessibility, universal design for learning, and Web Content Accessibility Guidelines, focusing on Internet and learning resource use in the United States. While these guides are helpful for individuals in the United States who simply want an overview of these concepts, the significance for researchers in other countries is limited. A broader evaluation across several countries is likely to have greater significance for this group.

Several studies have examined accessibility of university websites and learning management systems from around the globe, including Ahmi & Mohamad (2016) in Malaysia, Bhardwaj (2018) in India, and Kent, Ellis, and Giles (2018) in Australia. Each of these studies focuses only on a single nation, comparing the actual state of accessibility to an ideal. Comparative study, on the other hand, may give a more accurate assessment of what is realistic change, based on nations that are more/less advanced accessibility-wise. The assumption then becomes not that countries that are lagging in accessibility due to economic and social constraints should be held up to the ideal, but rather held to what other similar countries have accomplished (with the eventual goal still, of course, being the ideal).

Other aspects of accessibility (physical spaces, access to libraries and other information centers) have been explored in a limited number of articles. Moorefield-Lang, Copeland, and Haynes (2016) described the process of creating accessible library instruction at the University of South Carolina. Bodaghi and Zainab (2013) studied accessibility to facilities in university library buildings in Iran. Simonson, Glick, and Nobe (2013) examined students’ perceptions of accessibility of buildings on a public university’s campus. Generally, the scope of these studies is limited, in some cases focusing only on a single university. This limited scope also limits the representativeness of the findings.

How Data Was Collected

The “data” for this study were government publications, peer-reviewed journal articles, monographs, newspaper articles, and grey literature relevant to addressing the research problem. Data was reviewed by all members of the research team. From the data, a complete narrative was developed that illustrates the strengths and weaknesses in the implementation of accessibility in educational systems. Based on knowledge of the social, political, economic, and information infrastructures in the three nations studied, diffusion theory was applied in the analysis to identify possible means through which government and education officials in each nation can support the adoption of strengthened accessibility policy and practice.

Findings

Accessibility Law

United States

Section 501. Section 501 of the 1973 Rehabilitation Act guides equal opportunity employment for individuals with disabilities for organizations/entities receiving federal funding. This section requires all

federal/federally-affiliated organizations/entities to have in place an affirmative action plan to ensure equal opportunity in the hiring, placement, and advancement of individuals with disabilities. Section 508

Section 504. Section 504 is perhaps the most widely-known aspect of the Rehabilitation Act of 1973 and the most-commonly implemented aspect in schools and universities. This is otherwise known as the “reasonable accommodation” amendment (which would be further strengthened by the Americans with Disabilities Act). It directs all organizations/entities receiving federal funds to make reasonable accommodations, a modification in a job or work environment that will enable an otherwise qualified job applicant or employee with a disability to complete the application/interview process or perform essential job duties.

Americans with Disabilities Act. The Americans with Disabilities Act of 1990 (ADA) was the most sweeping piece of disability civil rights legislation ever passed by the United States Congress. The legislation consists of 49 sections within five titles that cover employment, public services, public accommodations and services operated by private entities, telecommunications, and miscellaneous provisions

Individuals with Disabilities Education Act. The Individuals with Disabilities Education Act (IDEA) was originally passed in 1975 as the Education for All Handicapped Children Act, and was reauthorized as IDEA in 1990, the same year that the ADA was signed into law. IDEA’s passage and subsequent revisions significantly broadened opportunity for students with disabilities. The aim of IDEA is to provide equitable educational opportunity for students with and without disability by building supports into the educational process.

W3C WCAG. The World Wide Web Consortium’s (W3C) Web Content Accessibility Guidelines (WCAG) were developed to guide accessibility compliance on the Internet. The accessibility guidelines are not in themselves legally enforceable, but have been adopted by many countries and organizations to guide their accessibility. There are 61 compliance criteria, sorted into twelve guidelines, which themselves are sorted into four principles. They are an important part of Section 508.

Section 508. Section 508 is an amendment to the Rehabilitation Act of 1973 (the second of the two acts passed in that year). The original Rehabilitation Act was developed pre-Internet, pre-cellphones, pre-personal computer so the law was amended in 1998 to meet new needs with these emerging technologies, and again in 2017 to better meet the technology requirements of the early 21st century. Section 508 requires federal agencies, and any institutions receiving federal funding, to provide equal access to all Information and Communication Technology (ICT) to individuals with disabilities. It suggests WCAG 2.0 Level AA compliance for providing this level of equal access.

China

People with Disabilities Act of the Peoples Republic of China. The Law of the People’s Republic of China on the Protection of the Disabled was amended and implemented in 2008 in accordance with the constitution. The law aims to protect the lawful rights and interests of disabled persons and ensure their equal participation in social life. It includes nine chapters and covers education, employment, social security, accessibility, and public entertainment.

Regulations of Education of Persons with Disability. The regulations of Education of Persons with Disability were originally passed in 1994, and revised in 2011 and 2017. The regulations aim to guarantee the individuals with disabilities have equal opportunities to access to education with individuals without disabilities. It stipulates preschool education, primary education, secondary education, higher education, and vocational education for the disabled.

Regulations on the Construction of Accessibilities. This regulation was passed in 2012 and aims to guarantee the accessibility of individuals with disabilities in social life. The regulation covers accessible infrastructure construction, information accessibility, and community service accessibility. In the part of information accessibility, public libraries shall establish reading rooms for the visual impaired individual, and provide braille and audio books; websites of disability organizations, governments, and public welfare shall meet the standards of website accessibility.

Nigeria

Nigerians with Disability Decree 1993. This Decree provides a clear and comprehensive legal protection and security for Nigerians with disability as well as establishes standards for enforcement of the rights and privileges guaranteed under this decree and other laws applicable to the disabled in the Federal Republic of Nigeria. The total 14 sections cover the rights of individuals with disabilities in education, employment, transportation, social life, and communications.

Discrimination Against Persons with Disabilities (Prohibition) Act 2018. This Act provides for the full integration of persons with disabilities into society and establishes the National Commission for Persons with Disabilities and vests the Commission with the responsibilities for their education, health care, social, economic and

civil rights. The Act covers the accessibility to physical structure, transportation, education, health care, and employment.

Physical Accessibility to Places of Education and Information

United States

Approximately 17% of young adults (age 18-44) in the United States have some type of disability, including 10% of young adults with a hearing, vision, or mobility disability that might impair the ability to participate in non-accessible higher education (Okoro, Hollis, Cyrus, & Griffin-Blake, 2018). Individuals who identify as White or Asian have the lowest incidences of disability, while individuals who identify as Black, Hispanic, Native American, or Multiracial, have an average incidence that exceeds 20%. Disability is yet another barrier that increases racial disparity (Fredrick & Shifrer, 2018).

It was within the United States that the predecessor of Universal Design principles was developed, by Timothy Nugent and colleagues at the University of Illinois (Reagan, 2017). Universal Design for Learning, the principles that guide accessibility design of instruction (especially in online learning settings), was also developed in the United States (Meyer, Rose, & Gordon, 2018). It was also a leader in the passage of disability rights and accessibility legislation, such as the 1973 Rehabilitation Act and 1990's Americans with Disabilities and Individuals with Disabilities Education Acts. This, however, does not mean that the United States is necessarily perfect in its adherence to accessibility guidelines. Particularly among older construction, accessibility can be a major barrier within the United States.

Universities tend to be some of the oldest buildings in the United States, with many constructed before accessibility measures like elevators and sloping entranceways (ramps) were invented or financially practical (Fisher, 2019). A disparity exists among more and less financially successful universities, where those universities fortunate to have a high level of financial success or receive sufficient funding from state sources or grants were able to modernize old buildings with accessibility elements. Less financially successful universities may be stuck with buildings that limit accessibility. Lawsuits over physical accessibility to university buildings are not uncommon. Nonetheless, U.S. universities excel in physical accessibility compared to nations where buildings have stood for many centuries, as is the case in many European and Asian nations.

China

By the end of 2010, there were over 85 million individuals with disabilities in China, including 12.63 million have a visual disability, 20.54 million have hearing disability, 1.3 million have a speech disability, 24.72 million have a physical disability, and 26 million have other disabilities (China Disabled Person's Federation, 2012). These individuals account for 6% of the total population of China. This incidence rate is relatively consistent with the percentage of Asian-Americans with disability.

A large number of physical accessibilities, such as ramps, elevators, tactile pavements, and restrooms for disabled individuals, was built between 2008 and 2010 for the Paralympics (Blauwet & Willick, 2012). However, several problems can be observed in those established ones, such as lacking standard ramps and braille for public facilities, design deficiencies and artificial obstacles of tactile pavement, and inaccessibility of public restrooms. The occasions frequently occur for a wheelchair cannot access to a ramp of a supermarket, for instance, as the supermarket sets up a circle of barricades outside the door to prevent the loss of shopping carts, and the slope is too steep to access. Most high-rise buildings install elevators for both individuals with and without disabilities, but some of them do not provide braille on the buttons, which stops persons with visual impairments accessing to it. Another occasion may occur that the braille on a public facility is inaccurate, such as rotating the braille 90 degrees, using English spelling for Chinese, and braille points out of place.

Tactile sidewalks are built in most walkways for person without disabilities, however, many of them laid discontinuously, which causes difficulties for visually impaired individuals to follow; some of them do not connect to a public facility, such as a hospital; and some of them are illegally occupied by either public facilities or private facilities. Many public facilities set accessible restrooms for individuals with physical disabilities, but part of them are held unlawfully and causes inaccessibility to disabled persons; some of the public bathrooms have signs for accessibility sign outside but do not install accessible devices, such as handles, inside.

The state of the economy is the leading cause of these deficiencies. Even though China has become the world's second-largest economic power, Chinese people were facing dearth before the 1970s. A government cannot consider the higher-level needs, such as accessibilities for disabilities, when it is struggling in feeding its people. Comparing with to the over 200-year history of the U.S. Disability Laws/Regulation/Act (Meldon, 2017), 50 years (start from the 1970s) is not enough for China to form a relatively complete legal system to protect disability's rights

and public awareness of the accessibility. The Chinese government has not stopped promoting to improve public awareness and investing heavily in protecting disabled person rights and improving circumstances. By the end of 2018, 2,364 comprehensive service facilities, 914 rehabilitation facilities, and 791 nursing homes for the disabled had accomplished with a total investment of 5 billion U.S. dollars (China Disabled Person's Federation, 2019).

Nigeria

Recent studies have shown that the population of people with disability in Nigeria grows at a steady rate of 1.08% every year since 2011 (Smith, 2011; Books2Africa, 2013; National Population Commission of Nigeria, 2018), currently amounting to 19 million or 9.5% of the 200 million Nigerians who are living with disabilities across six geopolitical zones (National Population Commission of Nigeria, 2018). Therefore, people with disability in Nigeria forms a large population of the less privileged- those who are less likely to access educational and informational resources and centers (Smith, 2011).

Prior to the enactment of the 1993 Disability Decree which empowers persons with disability with their human rights, including right to access places of education and information center and information resources, people with disability in Nigeria were mostly left to the mercy of their family or anyone who could provide them help to access public facilities such as information centers, health, and educational buildings (Rwomire & Raditlhokwa, 1996). However, the Discrimination Against Persons with Disabilities (Prohibition) Act (Federal Republic of Nigeria, 2018), among many things enforces the need for public facilities- education and information places own by the government, and any private body that render services to the public provide the necessary accessibility structure for people with disability. Facilities such as ramps, wheelchairs, parking spot for disabled persons, lifts for people with disability, braille signages and signs for the visual impaired are encouraged to be part of public places, especially within and around educational buildings and information centers. While such is encouraged by the federal government, however, not all public information and education centers provide facilities or renders services that would encourage accessibility by persons with disability in Nigeria (Ijadunola, Akintan, Afolayan, & Akanji, 2019).

Access to Learning Management Systems

United States

Canvas. Canvas LMS is designed to conform to WCAG 2.0 and Section 508 guidelines. Website provides links to compatible screen readers and walkthroughs of the features instructors can use to create accessible content. <https://community.canvaslms.com/docs/DOC-2061>

Blackboard. All Blackboard products are designed to conform to WCAG 2.0 Level AA and Section 508 standards; regular audits are conducted by a third-party organization. The website also provides information for educators about creating accessible course content. <https://www.blackboard.com/accessibility.html>

Moodle. Website provides some information about accessibility, but it is not easy for a user to understand. Making sure the LMS conforms to accessibility guidelines is a work in-progress. Some links to screen readers are provided for users.

China

There are few comprehensive learning management systems applied in higher education institutions, similar to the Blackboard and the Canvas, found. More systems are platforms provide specific professional training, such as English training, or coding training, which are similar to a systematic tutorial videos on YouTube. This situation may be caused by insufficient technological and educational resources.

Nigeria

Due to limitations in economy, not many learning management systems in higher education institutions are found in Nigeria. Most of them relate to corporation training, self-taught learning, or mobile learning as a supplement of primary and secondary education. In instances where LMS are used, it is generally Moodle, as this is an open-access, open-source LMS. Accessibility of Moodle is discussed in the U.S. section above.

Access to Library Management Systems

United States

Ex Libris: Ex Libris Library Management System conforms to WCAG 2.0 and Section 508 standards with exceptions. These exceptions are not explicitly mentioned.

SirsiDyinx: SirsiDyinx does not specifically mention if and which guidelines the LMS follows. Instead, the website indicates that if you experience a problem, you should contact the webmaster; if certain information is not accessible, customer service can provide it in an accessible format.

Innovative Interfaces: Innovative Interfaces admits that it does not fully conform to WCAG 2.0 or Section 508, but is constantly working to make changes to comply.

OCLC: OCLC states that it works to continuously adhere to WCAG 2.0 and Section 508 guidelines. Also provides Voluntary Product Accessibility Templates (VPAT) for each product.

Koha: Koha is an open-source library management system shell. As such, the accessibility of the system relies on the design given by system managers at the library.

China

CALIS (China Academic Library and Information System): It is aiming to promote and improve resource sharing among academic libraries, reduce expenses for participating libraries, and support development of higher education in China. It intends to build an infrastructure for resource-sharing and see multiple resource-sharing functions among participating libraries. It does not specifically mention if and which accessibility guidelines follows.

CASHL (China Academic Humanities and Social Sciences Library): It aims to cooperatively acquire, preserve and share foreign and Chinese periodical resources in the humanities and social sciences among member libraries, and provide a unified online portal for users to retrieve and utilize these resources. It does not specifically mention if and which guidelines of accessibility follows.

ILAS II (Integrated Library Automation System): The website introduces the technology applied in ILAS II and its functions, but does not specifically mention if any accessibility policies or regulations follow.

InterLib: The website introduces the developing computer languages, operation platform, system structure, etc., but does not mention if any accessibility policies or regulations follows

Nigeria

KOHA. The module of Frontoffice promotes the inclusion of all citizens. It is developed in accordance with the WCAG 2.0

Visionary Technology in Library Solution (VTLS). It does not specifically mention if any accessibility policies or regulations follow.

Millennium. It does not specifically mention if any accessibility policies or regulations are followed.

Access to Educational Websites

United States

Most university websites in the United States do a poor job of adhering to accessibility guidelines, like the WCAG 2.0. Lawsuits by disability rights groups towards universities is very common, including over 50 lawsuits filed by Jason Camacho in December 2018 against major universities such as Cornell and Vanderbilt University (McKenzie, 2018). In some cases, accessibility to websites in the United States can be worse than many other nations, because these websites incorporate dynamic elements (e.g., javascript) that have more limited compatibility with screen readers and other accessibility tools.

Educational websites not produced by universities, like Chegg and Google Scholar, are not necessarily held to the same accessibility standards. This, however, does not necessarily mean that accessibility is worse for these websites. As discussed, university websites' accessibility can be poor due to over-complexity, while Google's simple interface (a header and a search box) actually lends well to accessibility.

China

A university's website is generally providing the brief introduction about the university (history, current university leadership, successive leadership, and organizations), schools and departments, faculties, scientific researches, university news, enrollment, and job opportunities. The websites are more often used for promoting, which allow people to know more specifically about the university, such as new research subjects and on/off-campus activities.

Most designs of universities' websites are following the Universal Design principles, presenting various levels headings according to the contents and an aria-labels/labelledby for users of screen reader and keyboard, but most alternative texts for an image or an image link are missing. This situation may be caused by lacking relevant regulations and handbooks for website accessibility and social awareness.

Nigeria

Education websites owned by the various educational institutions in Nigeria provide little or no accessibility aid for people with disability. Some of the universities and other academic institution, and even information centers in Nigeria don't have an official website with a recognized domain name as encouraged by the Nigerian federal ministry of education. Therefore, most educational websites in Nigeria are not complaint to the accessibility needs of persons with disability, nor are they up to the recommended standard to be consider as an educational website.

Discussion

Comparing and Contrasting the Countries

Across the three countries of the United States, China, and Nigeria, financial situation appears to play a role in the capacity to provide accessibility. When a nation's universities can hardly afford a learning or library management system in the first place, there is limited emphasis on accessibility to these systems. Among United States institutions of higher education, those with lower financial standing tend to have more barriers to accessibility. In general, it appears that most institutions want or feel compelled to conform to accessibility guidelines, but it may not be financially feasible.

Among learning and library management systems, most do fairly well at complying with accessibility guidelines, or are in the process of doing so. The greatest challenge may be among the open-source systems, as the front-end design is left to each institution to design, meaning that accessibility can vary based on the quality of the design. These systems, however, are immensely valuable in developing countries like Nigeria, where educational institutions may otherwise not be able to afford any sort of system. Expansion in the use of these open-source educational systems is likely to only increase in nations like Nigeria, so local knowledge of accessibility principles at individual universities could prove vital to ensure the front-end design is accessible.

Institutions in the United States likely benefit from being located in the nation in which the major accessibility guidelines were developed. Knowledge of these guidelines appears limited in the other countries studied, with many educators appearing to learn the principles while studying abroad or online (Rao, Currie-Rubin, & Logli, 2016). This indicates that there may be limits to the diffusion of accessibility concepts to countries outside the United States.

How to Improve the Diffusion of Accessibility Concepts

The rate of diffusion of information in developing countries may be influenced by increasing access to information and educating information gatekeepers (professors, librarians, government officials) (Lund, 2019). As such, advocates for accessibility may benefit from the targeted dissemination of accessibility information to educators and institutions of higher education that do not presently observe them. As noted by Nishita, Liebig, Pynoos, Perelman, and Spegal (2007), opposition to accessibility policy can hamper diffusion; thus, it is important not only to educate the educators about accessibility, but also to be prepared to address the concerns and critiques of those who oppose accessibility. In regard to accessibility to educational systems, the greatest concern may be that accessible design takes valuable time away from the creation of content to help a small group of students. As found by Lazar, Dudley-Sponaugle, and Greenidge (2004), many web developers indicate that they would only make a website more accessible if a law compelled them to, because it is additional work and they believe the time is not worth the benefit. Advocates can push back against such critiques by pointing out, as noted by Lisney, Bowen, Hearn, and Zedda (2013), that accessible design produces positive outcomes for all users, not just those with disabilities, by forcing designers to engage in more purposeful and inclusive design.

From this comparison of accessibility in the United States, Nigeria, and China, advocates may be able to cite specific gaps in accessible design in their nation, and use examples from the other nations to identify what should or should not be done to improve these gaps. Each nation has clear gaps and can learn from the others. As Everett Rogers himself argued, diffusion of innovations is a theory of information exchange (Rogers, 2010). By exchanging information about accessibility principles and disparities among nations, the outcome will hopefully be greater adoption of these principles.

Conclusion

Discrepancies in conformance of educational systems to accessibility guidelines exists both within and across nations. The United States has the greatest conformance across education systems, but physical and website accessibility can vary based on a university's financial standing and the number of dynamic web design elements incorporated into a website. China and Nigeria both have limited conformance to accessibility guidelines, but are

also limited financially and in knowledge of accessibility principles. Greater collaboration among institutions worldwide is needed to facilitate the diffusion of information about accessibility principles and provide support of implementing these principles. Governments in these nations have a financial obligation to support improvements to physical accessibility. By implementing common-sense changes, conditions can be improved for learners with disabilities as well as those without disabilities.

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