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Digital accessibility for persons with disabilities: A mixed method study of websites of 15-top ranked universities of India

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Abstract

The present study was carried out using a mixed method sequential exploratory design to know the accessibility features for persons with disabilities available over the homepages of websites of top-15 ranked universities of India. The ranking used for this study was that of the National Institutional Ranking Framework (NIRF) released in 2020. Initially a manual observational analysis has been done for homepages of the websites of 15-top ranked universities of India for availability of fundamental accessibility features. In second phase an evaluation was made with automated web-accessibility tool 'koa11y'. It was observed that most of the top-ranked universities in India lacked the fundamental accessibility features screen reader access, change in font size, font colour change, text spacing and even most of them do not have an accessibility statement over their websites. The analysis through 'Koa11y' resulted in a mean of 50 errors, 162 warnings and 432 notices respectively indicating very poor accessibility features for persons with disabilities available on websites of top-15 ranked universities of India. The website of National Institutional Ranking Framework (NIRF was found having no/ very poor accessibility features. The Rights of Persons with Disabilities Act (RPWD Act) 2016 has a provision of enhancing digital accessibility and National Education Policy 2020 endorses all its provisions indicating a need to implement the Rights of Persons with Disabilities Act (RPWD Act) 2016 effectively to achieve equity and inclusion in higher education as envisioned in National Education Policy 2020.

Keywords

RPWD Act, NIRF, Web Accessibility, NEP 2020, Digital Accessibility

Introduction

The 21st century saw a digital revolution in every aspect of our lives and now the society became a digital society (Lewthwaite & James, 2020) where one has to use and access ~~of~~

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digital tools in one's daily activities whether it is banking, travel, education or any other activity. During the period of COVID-19, knowledge of and use of Information and Communication Technology (ICT) tools proved their importance and supported humanity to a greater possible extent. In fact, ICT tools are essential component of human lives which could not be separated from one's life. Many times uses of ICT tools make one's life easier, make certain things possible and less time consuming. The Internet user receives many benefits and has an easier life, whereas the non-internet user is excluded from all of the benefits of the internet and related technologies. The example of COVID-19 may be quoted as a good example of it. Internet users, whether teacher or student, continued their teaching and education through internet based real time interaction tools whereas non-internet users were deprived from this opportunity during the pandemic period and were left behind. Information and Communication Technologies offer many benefits to all including persons with disabilities and have great potential to support persons with disabilities in accessing several resources either educational, social, financial or any such other resources(Dobransky & Hargittai, 2006; Gorski & Clark, 2002) but unfortunately due to several reasons most people with disabilities are unable to use it as and when needed(Gorski & Clark, 2002). The reasons of this inaccessibility include unavailability of desired tools or inaccessible format of web-based information which created a 'digital divide' or more explicitly could be referred to as 'Disability Digital Divide' or 'Digital Exclusion'.

Digital divide is a well-established phenomenon which has been simply described as disparities in access to computers and the ICT tools among several groups of people based on personal limitations or social or cultural identity(Gorski, 2005). There is a positive relationship between poverty and digital divide as people from lower socio-economic status are more prone to experience digital divide than those having higher socio-economic status in society. As far as education and educational institutions either school education or higher education are concerned their websites provide an excellent platform for information dissemination (Kuppusamy & Balaji, 2021). The COVID-19 situation across the world introduced the power of information and communication technology in education across the globe. Web based mediums were and are widely used now in education in general and in higher education in particular to continue the education of students during and post COVID-19 pandemic. The educational scenario has been changed globally due to pandemic and education will be more and more ICT oriented in post-pandemic period as well. Technological advancements have created a schism

between traditional and modern educational systems and modern systems have been forcing traditional educational systems to evolve over time(Glahn & Gen, 2002).

Digital exclusion has been viewed as the lack of access to and the use of information and communications technology (ICT) resources (Macdonald & Clayton, 2013). Because of the exponential increase in Internet and related technologies and the lack of adequate attention paid to their accessibility, individuals who were already at danger of digital exclusion saw their situation worsen. The architecture of modern technology is a crucial factor in the exclusion of people with impairments from the digital world (Dobransky & Hargittai, 2016; Lazar et al., 2004).

Even if it's tough for developers to keep up with the quick changes in technology and ensure that all aspects of web-based content are accessible, it's important from a user's point of view. There are a number of socioeconomic or geopolitical factors that can make universal accessibility difficult, if not impossible. (Abascal et al., 2016). Sometimes lack of adequate policy or clear guidelines for web-developers are reasons for inaccessible web resources. To ensure that persons with disabilities have equal access to online-based content and related technology, web designers have adopted a philosophy known as universal accessibility(Abascal et al., 2016).

The growth and development of ICT tools and their continued inaccessibility led to the emergence of World Wide Web Consortium popularly known as (W3C) which has been continuously developing and updating regularly the Web Content Accessibility Guidelines (WCAG) with the development of ICT tools. As noted by (Kelly et al., 2007),

"Since 1997, the W3C's Web Accessibility Initiative (WAI) has been extremely active and very successful both in raising awareness of the importance of Web accessibility and in developing a model which can help organisations to develop accessible Web resources. (Kelly et al., 2007).

Universities play an important role in higher education and are the back-bone of the higher education system of a country. In a country like India, universities need to be well equipped with modern ICT tools and the websites of the universities need to be very rich in information and learning resources. With the growing trends of online learning, Massive Open Online Courses (MOOCs), Digital libraries, Digital self-learning materials and so on. have created a need for universities to make their website richer in all these information and make all the information available over the website of the university accessible for persons with disabilities based on the principles of universal design as the accessibility of web pages is among one of the very important criteria for disseminating

information to a wider group of audience(Aizpurua et al., 2016; Ismail & Kuppusamy, 2018, 2019). Accessibility and universality are essential aspects of web-based mediums(Ballesteros et al., 2015; Ismail & Kuppusamy, 2018; Ribera et al., 2009) and thus websites of universities need to have accessibility features.

Review of literature

When it comes to creating websites, universal accessibility has been seen as a way to ensure that persons with disabilities have equal access to web-based content and related technologies. Websites of universities are loaded with rich information and learning resources which can be used by a student as per the convenience. As a result, websites of universities are being studied for their accessibility features and accessibility standards for students with disabilities. Several such studies have been carried out across the globe. For example in Turkey(Akgül, 2021; Inal et al., 2019; Yerlikaya & Onay Durdu, 2017), in Spain, Chile and Mexico((Máñez-Carvajal et al., 2021), in South Africa (Verkijika & De Wet, 2020) in Jordan(Al-Kabi, 2018), in Canada, United States and Europe(Manzoor et al., 2019) in Kyrgyzstan, Azerbaijan, Kazakhstan and Turkey(Inal et al., 2019), in Portugal (Ismail et al., 2020), in Latin America(Acosta-Vargas et al., 2020) in Cyprus (İşeri et al., 2017) in Kuwait (AlMeraj et al., 2021), in Malaysia (Ahmi & Mohamad, 2016) and many others. Some studies used automated software or automated web-accessibility evaluation tools like Wave, Achecker, P11y while other studies used observational analysis to evaluate the accessibility features available over university websites and most of such studies found poor accessibility features of websites of universities for persons with disabilities indicating the need for further improvement.

Ismail & Kuppusamy, (2018) conducted a study on Accessibility of Indian universities' homepages. It was an exploratory study. Researchers of this study took a sample of 302 websites of Indian universities and analysed the homepages of sample universities under different level of compliance of Web Content Accessibility Guidelines 2.0. The analysis of the websites was made using automatic accessibility evaluation tools Achecker, Webpage analyser and the Wave. For collecting the Uniform Resource Locator (URLs) of websites for evaluation researchers also used a web scrapping tool: import.io. Further to find out and organize the accessibility report of websites , three groups were formed namely low accessible websites or Tier-III websites, medium accessible websites called Tier-II websites and highly accessible websites or Tier-I websites. The study

concluded the poor accessibility features of websites of Indian universities for persons with disabilities which need to be enhanced further. Very few such studies have been carried out in Indian context and very few of such studies were concerned with mixed methods research design for such studies.

AlMeraj et al. (2021) conducted a study to assess the accessibility of higher education institution websites in Kuwait. Researchers conducted this study on the websites of forty-one government and private universities in Kuwait. The study used several automated accessibility checkers, including A-Checker (which is no longer available), Wave, HTML and CSS Validators, to determine whether the websites of universities in Kuwait are accessible to people with disabilities. When assessed using multiple automated accessibility validation automated tools, the results revealed that the websites of Kuwaiti universities were non-compliant with WCAG 2.0 and had poor accessibility features.(AlMeraj et al., 2021)

Carvajal (2020) conducted research on the web content accessibility of Chilean universities based on the World Wide Web Consortium's Web Content Accessibility Guidelines 2.0 (WCAG 2.0). (W3C). The homepages of 57 Chilean universities' websites were examined. For this accessibility assessment of Chilean university websites, researchers used several automated accessibility checkers in which the Hyper Text Markup Language (HTML) grammar was used in web pages to determine if it allows adequate interaction with assistive products designed for people with disabilities. The researcher used the W3C Markup Validation Service to see if a university's website contained errors in the source code that rendered it inaccessible. According to the author, the study used the Web Accessibility Test (TAW), which analyses a web page based on WCAG 2.0 and provides a detailed report with errors and warnings for each page. In May 2019, the web pages of Chilean universities were evaluated. It should be noted that in this type of study, in order to obtain reliable data, it is necessary to record the time when the assessment was performed, as web-contents are subject to change over time. The study's findings revealed that, in Chile, websites of higher education institutions had serious difficulties complying with WCAG 2.0 ‘AA’ level accessibility guidelines and had poor web accessibility features available on university websites. It was also discovered that university websites were not user-friendly for people with disabilities who used assistive technology(Carvajal, 2020).

Carvajal et al. (2021) conducted a similar accessibility study in which researchers evaluated the web accessibility of university home pages in Spain, Chile, and Mexico.

The home pages of the top-15 ranked websites in Webometrics' ranking served as a sample for this study. This study, like the previous one conducted in Chile, used automated tools to assess the level of compliance of these universities' websites with the WCAG 2.0 guidelines. The results revealed that the websites of universities in Spain, Chile, and Mexico did not comply with WCAG 2.0 (Máñez-Carvajal et al., 2021).

Objectives of the study

In recent years, the Indian Education System in general and Higher Education System in particular has seen a paradigm shift with the introduction of National Education Policy 2020. The New Education Policy 1986 has become obsolete now and India will observe a new, totally overhauled education system. The National Education Policy 2020 of India has a prime focus on providing inclusive education to ensure equity and inclusion in line with Sustainable Development Goals –4. Accessibility is the primary criteria for an inclusive education as well as for an inclusive society. The National Education Policy 2020, section 14 is dedicated to equity and inclusion in higher education and the sub section 14.3 mentions that:

"There are certain facets of exclusion, that are particular to or substantially more intense in higher education. These must be addressed specifically, and include lack of knowledge of higher education opportunities, economic opportunity cost of pursuing higher education, financial constraints, admission processes, geographical and language barriers, poor employability potential of many higher education programmes, and lack of appropriate student support mechanisms".

In the above subsection it is very clear that certain aspects of the higher education system, such as economic opportunities, the cost of pursuing a degree, financial constraints, admissions processes, removal of geographical and language barriers, as well as appropriate student support mechanisms need to be improved in order to reduce the intensity and degree of exclusion. Needless to mention here that in present information and internet tools-based society of India, the websites of universities may address these awareness function very well like providing knowledge of higher education opportunities, providing ICT based faster student support services, improving employability and other such information. A comprehensive website of a university or a higher education institution can do better to address the issues mentioned in subsection 14.3 very well to reduce the intensity of exclusion at higher education level in India but what if there are

websites, rich in information but lack accessibility features? Due to digital inaccessibility of web-resources, those who are currently excluded will continue to be so through digital exclusion. There is a large number of people with disabilities who remain excluded from benefits of web-based resources due to inaccessible format of web-sites. An information rich but inaccessible website of a university is not going to make any difference and is not capable of fostering inclusive higher education which, in turn, will break millions of dreams of higher education. The objective of this study was to evaluate the accessibility features of the websites of India's top-15 ranked universities in order to gauge the dream of NEP 2020 to ensure equity and inclusion in higher education.

Methodology

The sample for this study were home pages of websites of 15 top-ranked universities of India as per the NIRF Ranking 2020. A National Institutional Ranking Framework (NIRF) was started by Government of India, Ministry of Education (then Ministry of Human Resource Development, MHRD) in 2015 which first released the ranking of institutions in 2016 based on several parameters suggested by an expert committee constituted for this purpose. (Mukherjee, 2016; NIRF, n.d.).This ranking of Indian Higher Education Institutions was based on five basic parameters: Teaching, Learning and Resources; Research and Professional Practices; Graduation Outcomes; Outreach and Inclusivity; and the Stakeholders' Perceptions respectively divided into several objective and measurable sub-parameters. The higher education regulator of India, the University Grants Commission (UGC), further made it mandatory to carry out the ranking every year (NIRF, n.d.). Present study was a mixed method study using a sequential exploratory design which studied fundamental accessibility features of top-15 ranked universities' websites. In first phase, qualitative observations were made of home pages of top-15 ranked universities' websites and in second phase the quantitative data were collected using the automated web evaluation tool Koa11y. NIRF ranking 2020 of higher education institutions of India ~~which~~ taken into consideration. The study used qualitative data dominant design which is sequential exploratory design, thus, qualitative and quantitative both types of data were collected. The first phase started with qualitative data collection through observation, followed by quantitative data collection phase using automate accessibility evaluation tools. In first phase, we carried out an observational analysis of home pages of websites of top-15 ranked higher education institutions under the category

of universities of India by NIRF in 2020. It was focused on availability of different accessibility features on websites of top -15 ranked universities. The accessibility features included six fundamental features for observational verification of the home pages of top-15 ranked higher education institutions' websites ranked under university category by NIRF in 2020. The features assessed were Screen Reader access, Font Size change options, High Contrast Text options, Font Colour change options, Text Spacing options and availability of accessibility statement.

In second phase in order to supplement the manual assessment of accessibility features of websites, an automated web content evaluation tool 'Koa11y' was used and automated evaluation of home page of websites of each of the top-15 ranked institutions of Higher Education in India was carried out. The accessibility evaluation tool Koa11y is a desktop app that allows to automatically detect accessibility (a11y) issues on webpages (Koa11y, n.d.). Koa11y is a very comprehensive tool for evaluation of accessibility. Koa11y was created using Pa11y, Vue.js (the progressive JavaScript framework), and NW.js(node-web kit)(Koa11y, n.d.; NW.JS, n.d.; P11y, n.d.). The result of Ko11y is broadly classified in three dimensions: errors, warnings, and notices. Errors are accessibility related mistakes in source code whereas warnings and notices indicate a probable error which need attention of the developer. The detail report of web accessibility generated through Koa11y could be saved in many formats and is an open-source software. Home pages of top-15 higher education institutions ranked in the University category by NIRF were taken into account for evaluation using the Koa11y. The assessment of home pages of these top-15 ranked higher education institutions were carried out on 15th August 2021 between 7.00 PM to 11.00 PM. The date and time of evaluation are extremely important for the present study as webpages are subject to frequent changes with time. The evaluation was made setting the standard of accessibility 'WCAG 2.0 AA level'. There were other options but as Guidelines for Indian Government Websites 2019 (GIGW, 2019) endorses WCAG 2.0 at AA level for accessibility and based on it, the same was set as standard while evaluating the accessibility.

Sampling and Sample: The sampling used for the study was purposive one and the home pages of websites of top 15 universities of India and the home page of NIRF were selected to study the availability of accessibility features. The institutional ranking of Indian higher education institutions by NIRF released in 2020 was taken into account for sample selection. The idea behind selection of home pages of websites of these

institutions was that: as these are top 15 universities of India, more and more students including learners with disabilities will prefer them for their higher studies and in such a case, it is expected from these top ranked universities or Higher Education Institutions (HEIs) that their websites to have more digital accessibility features than that of lower ranked HEIs so that students with disabilities could also get equal opportunity to study at top ranked HEIs of India without any discrimination. As a sixteenth subject, the website of NIRF was also included for the study assuming that a student with disability will first search the NIRF for ranking of the university prior to applying for any academic degree he/she wishes to pursue like his/ her non-disabled peers. The data collection was made from 15th July to 15th August 2021 and a screenshot of the home page of each 15 top-ranked universities was taken to keep the record. The similar was done with the home page of the website of the NIRF. The detailed report generated from Koa11y automated accessibility checker was also kept for record for each institution selected as sample.

Results

Even the fundamental features of accessibility like High contrast text, Text Spacing, Accessibility Statement, Font Colour were available only on the websites of 6% universities indicating a serious lack in accessibility features of websites despite the enactment of Rights of Persons with Disabilities Act 2016 which came in force in 2017 and celebrating its 5th year. The access of screen reader was available on websites of only 13% universities and 26% universities under top-15 rank of NIRF provided increase in font size option. The data revealed that websites of all these top-15 ranked universities by NIRF India and the website of NIRF too failed to provide basic accessibility features for persons with disabilities and not in compliance with either WCAG 2.0 guidelines or with GIGW 2019 guidelines indicating their failure to follow basic principles of digital accessibility which are Perceivability, Operability, Understandability and Robust (WCAG 2.0).

Table 1. Accessibility features available over top-15 ranked universities of India

Features	Percentage of universities
Screen Reader access	13%
Font Size	26%
High Contrast Text	6%

Font Colour	6%
Text Spacing	6%

Table 2. Summary of report of accessibility produced by 'Koa11y'

Name of the University	Ranking in NIRF (2020)	URL	Errors	Warnings	Notices
Indian Institute of Science	**1**	https://iisc.ac.in	118	59	390
Jawaharlal Nehru University	**2**	https://www.jnu.ac.in/main/	19	77	83
Bnanaras Hindu University	**3**	https://www.bhu.ac.in/ https://new.bhu.ac.in/Site/Home/1_2_16_Main-Site	31	62	109
Amrita Vishwa Vidyapeetham	**4**	https://www.amrita.edu/	78	112	366
Jadhavpur University	**5**	http://www.jaduniv.edu.in/	17	68	277
University of Hyderabad	**6**	https://uohyd.ac.in/	91	60	236
University of Culcutta	**7**	https://www.caluniv.ac.in/	28	50	185
Manipal Academy of Higher Education	**8**	https://manipal.edu/mu.html#	79	138	514
Savitribai Phule Pune University	**9**	http://www.unipune.ac.in/	43	403	310
Jamia Millia Islamia	**10**	https://www.jmi.ac.in/	171	255	368
Delhi University	**11**	http://www.du.ac.in/	74	584	2494
Anna University	**12**	https://www.annauniv.edu/	16	414	130
Bharathiar University	**13**	https://www.b-u.ac.in/	27	90	246
Homi Bhabha National Institute	**14**	http://www.hbni.ac.in/	2	64	129
Birla Institute of Technology & Science, BITS Pilani	**15**	https://www.bits-pilani.ac.in/index.aspx	32	54	543

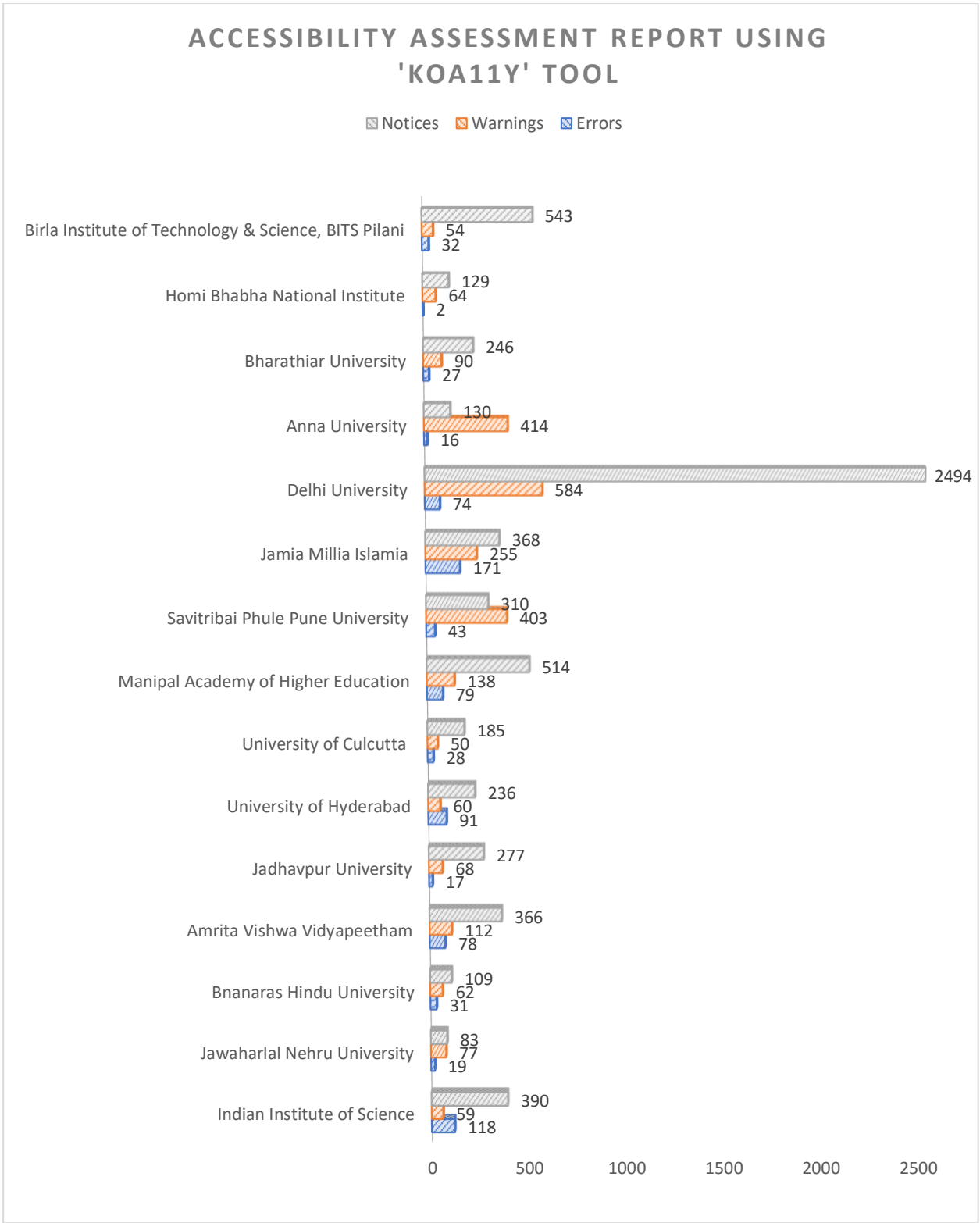

Figure 1Koa11y report of 15 universities

Discussion

Higher Education in India evidenced a radical growth in the number of Universities or University level Institutions & Colleges after Independence. The number of Universities has increased 34 times from 20 in 1950 to 677 in 2014 (Department of Higher Education, n.d.). Now India has a very large system of higher education comprising 3.85 crore enrolled students with a Gross Enrolment Ratio (GER) of 27.1 and a pupil teacher ratio is 1: 26 ((Department of Higher Education, n.d.)). In order to foster the needs of these learners there are around 1.5 million teachers involved in higher education and there are 1043 universities, 42343 colleges & 11779 stand-alone institutions catering the population of 3.85 crore. Also, there are 92381 persons with disabilities ~~are~~ enrolled in different Higher Education institutions which is about 0.02% of total enrolment. The RPWD Act 2016 provides 5% reservation in admissions which yields that at least about 2 million students with disabilities to be enrolled in HEIs in present situation indicating very poor condition of inclusivity of higher education in India. The data indicates that a very lesser than expected number of students with disabilities are enrolled in higher education in India. Among several reasons like inaccessible physical infrastructure, lack of awareness, poverty and so on the reason of very poor enrolment of persons with disabilities in HEIs may also be attributed to poorly designed websites of Indian Higher Education Institutions information given on which are poorly accessible to persons with disabilities.

The assessment through Ko11y yields a total of 753 accessibility errors, 2427 warnings and 6185 notices with a mean of 50 errors, 162 warnings and 432 notices respectively. The possible reason for this high error, warning and notices might be inadequate or no training of web-administrators and developers on basic accessibility issues and features. Also, it indicates a need of inclusion of WCAG and GIGW guidelines 2019 in all computer courses so that developer will be aware of accessibility issues. In addition, a short-term training on accessibility and WCAG as well as GIGW guidelines may be made mandatory for all web developers for which online learning, MOOCs may be used. Also, there is a need of Digital Accessibility Audit of websites of all higher education Institutions of India to improve their accessibility features and such audit should be made mandatory by making appropriate policy after every two or three years. The result of this study is consistent to those studies of university websites carried out in different countries for their accessibility features and poor web-accessibility features

have been observed in many countries like in Turkey,in Spain, Chile and Mexicoin south Africa, in Jordan, in Canada, United States and Europe,in Kyrgyzstan, Azerbaijan, Kazakhstan and Turkey, in Portugal, in Latin America,in Cyprus , in Kuwait, in Malasia but for a country like India, the accessibility of web based information is very important as India has enacted RPWD Act 2016 in line with United Nations Convention on Rights of Persons with Disabilities (UNCRPD) 2006 and has made the provisions for increased digital accessibility and if it has not been achieved after five years of enactment of RPWD Act 2016, it is a matter of great concern.

The Chapter-VI of Rights of Persons with Disabilities Act, 2016 deals with accessibility features in general. The section-15 specifies rules for accessibility in which 15-C (i) and (ii) are particularly related to Digital Accessibility mentioned as follows:

"(c) Information and Communication Technology

(i) website standard as specified in the guidelines for Indian Government websites, as adopted by Department of Administrative Reforms and Public Grievances, Government of India;

(ii) documents to be placed on websites shall be in Electronic Publication (ePUB) or Optical Character Reader (OCR) based pdf format Provided that the standard of accessibility in respect of other services and facilities shall be specified by the Central Government within a period of six months from the date of notification of these rules".

(2) The respective Ministries and Departments shall ensure compliance of the standards of accessibility specified under this rule through the concerned domain. regulators or otherwise.

In addition to making website digitally accessible, RPWD Act 2016 has a provision of periodic Accessibility Audit. The Section-16 of Chapter-VI of RPWD Act, 2016 made provision that The Central Government shall review from time to time the accessibility standards notified based on the latest scientific knowledge and technology.

Conclusion and limitations: Present study provides insight on current status of digital accessibility features of websites of 15 top ranked universities in India and indicates a dire need to improve accessibility features of websites of universities in India, however the study is limited to only 15-top ranked universities. Web accessibility audit of university websites for all the universities may be carried out for actual picture. This study considered very limited, visible features of accessibility whereas there may be several lacks in source code, not visible otherwise on website to a user but such errors

could be easily identified by information technology experts, and thus such comprehensive study may be carried out further. Universities across the globe need to be investigated for accessibility of digital information as findings of this study is similar to the studies carried out across the world.

Access to education is necessary to develop and achieve full potential and to be a productive member of society but many persons with disabilities aspiring higher education still experience numerous barriers in accessing education (Hersh & Mouroutsou, 2015)and the poor accessibility features of website of universities in general and top-15 ranked universities in India in particular may be a major reason behind it. Persons with disabilities are not getting enough information available over websites of universities leading to very a smaller number of enrolment of these individuals in different programmes of higher education at universities. Digital accessibility of issues of websites of universities as well as the website of NIRF or such other higher education bodies need to be addressed urgently to improve enrolment of persons with disabilities in higher education and to achieve equity and inclusion in higher education in India as committed by National Education Policy 2020. Also, as NEP 2020 endorses all the provisions of Rights of Persons with Disabilities Act which already have a provision for improving digital accessibility for persons with disabilities, proper implementation of RPWD Act 2016 has to be ensured to achieve the higher education system as envisioned in NEP 2020.

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