Original Research Paper

Management

E-ACCESSIBILITY FOR STUDENTS WITH DISABILITIES

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ABSTRACT The study attempts to understand and address the various issues and challenges faced by students with disabilities in accessing digital resources especially at higher educational levels. The research objectives framed or the study aimed at: a) identifying the various standards of accessibility, b) understanding the barriers faced in e-accessibility and c) finding solutions to the challenges faced by students with special needs. The research method adopted for the study consisted of collecting both primary and secondary data. A survey of 10 educators from schools in and around Coimbatore district, Tamil Nadu, including both special and general educators, was carried out to gain primary data on the barriers faced by students with special educational needs in accessing digital content. The secondary data helped in the identification of various standard guidelines and principles for promoting web accessibility. The study findings reveal that educators, students and authors of e-content should be sensitized towards the various web accessibility guidelines and techniques. Further, the use of assistive technology should be promoted as a reasonable accommodation for accessing digital information based on user preferences which should be mapped with the e-learning resources and environment through generation of user profiles. The study also supports the inclusion of assistive technology in a child's individualized educational program for facilitating e-inclusion and e-accessibility thereby promoting academic progress of the child.

INTRODUCTION

Education is needed for the development of skill and knowledge. Education acts as a tool for bringing change in the social and economic outlook. Gaining education especially higher education equips students with better professional competencies, to gain employment opportunities and also afford higher standards of living ("Accessibility", 2020). However, education especially higher education has always been a challenge for students with disabilities owing to presence of numerous barriers - social, attitudinal, infrastructural, physical, economical, geographical etc. Students with disabilities despite inclusion at elementary and secondary levels of education display high dropout rate in the higher levels of the educational system (Wolanin & Steele, n.d.). The advent of various online educational platforms such as MOOCs and other e-learning systems has made higher education an accessible option for many learners, including students with specialized needs. The flexible format, absence of physical barriers and rapid advancements in the form of enabling technology have made students with disabilities capable of participating in higher education thereby opening new domains of professional and personal development for this marginalized section of the society. But, despite several advantages of e-learning, numerous questions emerge out from the reviewed literature such as: Is e-learning fully inclusive? What are the various standards of e-accessibility? The present research study makes an attempt to answer all such questions.

Concept and origin of accessibility

The Oxford dictionary defines accessibility as "the quality of being able to be reached or entered". Accessibility can also be seen as the "ability to access" and in turn be benefited ("Accessibility", 2020). In general use, accessibility has gained popularity in connection with the design of products, services, devices and even human environments especially with respect to enabling accessibility for people with specialized needs.

The origin of the term accessibility can be traced back to the 14th century from French 'accessible' and Latin 'accessibilis' (etymonline.com). However, the term came in regular usage with the advent of Advocacy and Disability Rights Movements with the focus on ensuring equal access and equal rights for individuals with disabilities. Inaccessibility can be termed as a 'mismatch' between the needs of an individual and the surrounding environment (Gay, 2014). The Rehabilitation Act of 1973 also focused on the 'equity in access' for individuals with disability (Bishop, 2018). Section 504 of the Act states:

"No otherwise qualified individual with a disability … shall, solely by reason of his or her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity …"

- Rehabilitation Act (1973)

Section 508 and 255 of the Rehabilitation Act was amended in 2018 to "harmonize the information and communication technology accessibility standards worldwide" (Bishop, 2018). The section 508 guidelines prescribe some basic accessibility features such as: large text font size, color contrast, presence of alternate text for inaccessible plug-ins, presence of text and close captioning for animations and videos and user friendly navigation. The term accessibility was highlighted in the Americans with Disability Act (ADA), 1990 (Gay, 2014).

Telecommunications Act (1996) emphasized that telecommunications products and services should be made accessible to persons with disabilities, "products should be designed, developed and fabricated to be accessible to and usable by individuals with disabilities".

The United Nation Convention on Rights of Persons with Disabilities (2008) emphasized the need for removal of barriers and providing equal access to Information and Communication Technologies (ICT) for the disabled. Reasonable accommodation facilitates the provision of certain effective conditions, equipments and environment for an individual with disabilities (Zamora, n.d.). The use of reasonable accommodations can promote e-accessibility for individuals with disabilities in order to facilitate inclusion.

Concept of e-accessibility

The World Health Organization (WHO) defines e-accessibility as "ease of use of ICT by people with disabilities" (WHO, 2013). The ICTs include internet, websites, web pages, audio and video content and other forms of digital content. Hence, e-accessibility ensures that digital and web based information is adapted and presented to people with disabilities in various modes based on their unique needs (Gay, 2014). E-accessibility can facilitate 'e-inclusion' which can be understood as a form of inclusion through promotion of access

to digital Information and Communication Technologies.

According to Lamba (2019) educators should incorporate inclusive, universal designs in the teaching learning process and being aware of the diverse abilities among students in a class helps them to address the problems faced by learners better. Similarly, the concept of e-inclusion can be found based on the Universal Design which stresses the need for a "highly adaptable solution" accessible for all without any special modifications. Similarly, in the case of e-accessibility, the design of user interface and digital resources should be aimed for universal usage without the need for any special accommodation and adaptation ("e-accessibility and e-inclusion", n.d).

Despite the flexible approach of online learning systems, several concerns exist such as:

• The digital web interface may not be accessible.
• The e-learning resources and web content (information on the web page) such as colour, text, font, code, images, sounds, markup may not be accessible.
• Several accessibility barriers exist within the Learning Content Management System (LCMS) and Learning Objects for users with specialized requirements.

OBJECTIVES
The current research was conducted with the following aim and objectives:

1. To identify the various standards for promoting e-accessibility.
2. To understand the various barriers faced in e-accessibility by Individuals with Disabilities.
3. To identify the various solutions for addressing the barriers in e-accessibility for Individuals with Disability.

Research Questions
1. What are the various standards and guidelines for e-accessibility?
2. What are the various barriers faced in e-accessibility by students with disability?
3. What are the solutions for addressing the various issues of e-accessibility?

RESEARCH METHODOLOGY
The study involved two phases. The first phase of the study dealt with collecting secondary data related to the concept, meaning and origin of accessibility and web accessibility. Various published journal articles, reports, policy documents were analyzed in a detailed and critical manner. The second phase consisted of a survey study in which data was obtained from 10 educators (n1= 5 general educators and n2= 5 special educators) from in and around Coimbatore district of Tamil Nadu. Participant details are as follows:

Table-1: Participant Profile

Type of educator	number	Age group	number	Type of school	Number
General educator	5	20-40 years	7	Inclusive	2
Special educator	5	40-60 years	3	Special	8
TOTAL		10			

A questionnaire having both closed and open ended questions on e-accessibility for students with disability was exclusively designed for the present study. The results obtained were analyzed using descriptive statistics and the findings helped us to answer the research questions framed by the researcher for the present study.

RESULTS
Research Question-1: What are the various standards and guidelines for e-accessibility?

Findings:
To address various concerns of e-accessibility, the e-learning resources and e-learning environment have to be designed in a manner which will allow students with special needs to gain access to online resources and learning within the e-learning environment. The web accessibility guidelines are specially designed to ensure maximized e-access for users with disabilities.

Web Content Accessibility Guidelines (WCAG): The Web Content Accessibility Guidelines were developed by the World Wide Web Consortium (W3C) as a 'single shared standard of web accessibility' ("Web Content Accessibility Guidelines", 2018). The W3C introduced the Web Accessibility Initiative (WAI) in 1997, which aimed at making online information accessible to individuals with special needs. WCAG was originally meant for developers of e-content, authoring tools, web accessibility evaluation tools and others in need of standard guidelines applicable to all forms of ICT. The WCAG 2.0 guidelines (published in 2008) apply to technology and should be in compliance with Section 255 and 508 of Rehabilitation Act in order to promote equitable access to web based learning and working opportunities. According to the WCAG, there are three levels of conformance to the standards, as depicted in the figure below:
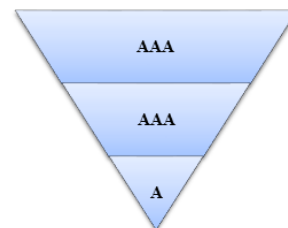

Figure-1: The three levels of conformance (A-lowest, AAA-highest) Four principles of web accessibility ("Web Content Accessibility Guidelines" 2018):

• Perceivable – The web content (digital information) and user interface should be presented in manner perceivable to the user through the existing senses.
• Operable – The user must be able to operate and interact with the user-system interface.
• Understandable – The user should be able to understand the interface and the web components.
• Robust – The content should be interpreted in a reliable manner by different user agents (Assistive Technologies)
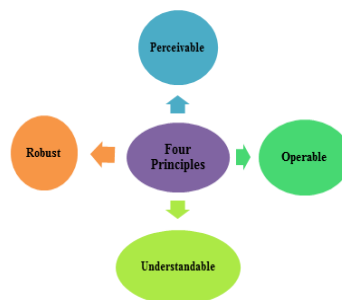

Figure-2: Four principles of accessibility

WCAG- Layers of Guidance:
In order to meet the diverse needs of web users, the developers, educators, authors and students need to understand and follow the WCAG 2.1 Layers of Guidance (according to "Web Content Accessibility Guidelines", 2020):

- The 4 principles form the top layer that provides the foundation for Web accessibility.
- The second layers composed of 13 non testable guidelines indicate the basic goals for authors to make content more accessible to users with different disabilities.
- The third layer is made of testable Success Criteria for each guideline, and for defining the three levels of conformance: A (lowest), AA, and AAA (highest).
- The last layer termed sufficient and advisory techniques for each of the guidelines and success criteria documents a wide variety of techniques.
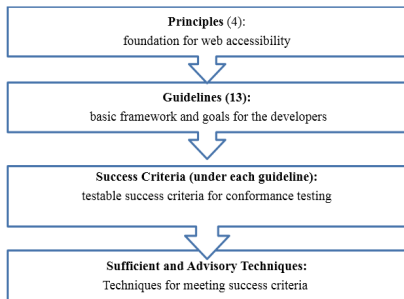
Figure-3: The four layers of guidance

Research Question-2: What are the various barriers faced in e-accessibility by students with disabilities?

Findings: The data collected from the participants (n=10) reveal the following barriers in e-accessibility for students with disabilities:

Table-2: Barriers faced by students with disabilities in web accessibility

Nature of Disabilities	Barriers in e-accessibility
Visual Impairment (low vision, colour blind, totally blind)	Small text/font size
	Low contrast colors
	Poor visibility of text on web pages
	Poor navigation and user interface
	Inability to use computers for accessing e-content in absence of screen readers
Hearing Impairment	Difficulty in understanding videos, animations
	Difficulty in recognizing audio based alerting systems
Loco motor Disability	Difficulty in using keyboard and mouse
Learning Disability	Spelling and grammar errors while typing
	Difficulty in recognizing alphabet and number keys on the keyboard

Research Question-3: What are the solutions for addressing the various issues of e-accessibility?

Findings: The findings are as stated below:
a) Need for matching learner profile and preferences
The various needs of the learners, their unique demands and user-preferences need to be declared and matched with the e-learning environment. Hence, the learner's profile, learning environment and learning content have to be matched together for the efficient usage by web users.

Figure-: Matching of learner profile, e-resources and e-environment
The user preferences can be stated as 'user profile' which can contain the following information:

Table-3: User profiling and declaration of preferences to access e-content

S. No.	Information	Description
1	Display information	This information deals with user preference regarding the display and presentation of information. Features: • Cursor: size, thickness, color, shape • Font: size, nature, color • Background and foreground: color contrast
2	Control information	Defines the user preferences with respect to control of device. Features: • Define use of screen readers: speech rate, pitch, volume, voice type • Alerting systems: visual or aural alert systems • Touch screens facilitate easier control and manipulation of device
3	Keyboard preferences	Allows the user to define their keyboard preferences-alternate keyboard Features: • Onscreen keyboard • Mouse emulators ex. Camera mouse • Alternate pointing mechanisms ex: head pointer, foot pointers • Foot pedal mouse • Adapted switches • Large print keyboards • Trackball mouse
4	Content display preferences	The user will define the type of media format for display of content, nature of adaptations and accommodations. Declare the requirement of accommodations and multiple adaptations. Features: • Alternate to text information • Alternate to visual information • Alternate to audio information • Alternate media for videos and animations: closed captioning, textual display
5	Security of personal information	The user will be aware of the safety features available for security of digital data and his/her user information. Features: • Encryption • Passwords • Usernames

(Source: adapted from "e-accessibility" n.d.; Gay, 2014; "Web Content Accessibility Guidelines", 2018)

a) Usage of Assistive Technology
The Information and Communication Technology (ICT) can be immensely beneficial to the society however for individuals with specialized needs, their access to ICT systems may be challenging and impaired due to functional limitations owing to the presence of various forms of impairments and disabilities (Banes & Thurston, n.d.). Assistive Technology (AT) can be used to provide various reasonable accommodations and adaptations to meet the wider range of diverse needs.

Review of literature revealed various case studies with clear indicators regarding the ability of AT to promote e-accessibility for web users with special needs.

Table-4: Use of Assistive Technology to promote e-accessibility

Nature of Disabilities	Assistive Technology to promote e-accessibility
Visual Impairment (low vision, colour blind, totally blind)	Text magnifier/onscreen magnifier
	High contrast visibility
	Screen readers
	Websites adherence to WCAG
	Refreshable Braille Display
	Talking calculator
	Digital voice recorders
Hearing Impairment	Closed captioning
	Visual alerting systems
	Text option for animations and videos
Locomotor Disability, Quadriplegia	Foot pedal mouse
	Adapted switches
	Camera mouse
	Head pointers
	Onscreen keyboard/Virtual keyboard
Learning Disability	Word Processor with spell check and grammar check
	Online text highlighters
	Word prediction software
	e-graphic organizers
Communication Impairment	Text to Speech software and applications
	Touch screen

(Source: adapted from "Accessibility", 2020)

c) Integrating Assistive Technology in the IEP of the learner
The use of Assistive Technology can help the child to achieve the goals outlined within the Individualized Educational Plan (IEP) and thus facilitate the success of the learner in school (Young & MacCormack, n.d). According to the Centre on Technology and Disability, it is the responsibility of the family members to strongly advocate for the inclusion of the assistive tools and services needed by their child with special needs in his/her IEP. Such adaptive and assistive equipments can support e-inclusion for students with special educational needs ("Assistive Technology and the IEP", n.d.).

d. Ensuring e-accessibility in the inclusive classroom
Nowadays, assignments, notes, tests and other learning resources are being provided to students in an online format both in schools and colleges. It is thus the responsibility of educators to take simple yet effective measures to ensure e-accessibility for all resources provided to learners with different abilities. Gay (2014) lists out some key initiatives for educators to maximize accessibility for Microsoft Office documents (such as MS Word, PowerPoint, Adobe PDF) which include:

• Use of text alternatives (example: 'alt text') to replace images and other visual elements present in the document, for learners with visual impairment.
• Preference for using structural elements such as 'apply styles', 'heading' available on word processor for structuring the document.
• Usage of high contrast colors like black and white, yellow and black.
• Providing large print text to learners with low vision.
• Providing audio input for visual elements in online tests.
• Installing screen readers for students with visual impairment.

• Provide accessible PDF to such learners.

RECOMMENDATIONS
• There is a primal need for matching the web user's preferences, needs with the e-learning resources and the e-learning environment in terms of user profiling.

• Assistive Technology can be used to facilitate and promote access to ICT. Hence judicious selection of AT on the basis of user needs can provide reasonable accommodation thereby supporting e-accessibility.

• AT should be closely integrated with the learner's IEP to maximize the potential and beneficiary effects of usage for ensuring learners progress in school and home.

• The e-content developed by educators and other authors should follow the WCAG 2.0. The web-sites, web-pages and all e-resources should be evaluated in terms of the various principles, guidelines, standards and techniques as mentioned in the guidelines.

• Parents, educators and school/college administrators should be sensitized regarding the need for provision of web-accessibility for learners with special needs. Educators should be trained in skill of creating e-accessible learning resources and online tests.

IMPLICATION IN HIGER EDUCATION:
This study aims to create awareness regarding e-accessibility amongst the academic community, parents, students with and without specialized needs and the policy makers, e-content developers for ensuring equitable access to digital learning tools and online platforms for pupils with special needs enrolled in special and inclusive schools at all levels of education especially higher education. E-accessibility can promote academic excellence for the learners with disabilities and provide them equal opportunity to quality education, better work opportunities and thereby ensure high Quality of Life.

CONCLUSION
Online learning is the 'new normal' especially with the increasing dependence of educators, learners and authorities on the virtual learning platform as an accessible, flexible and cost effective medium for reaching out to users both nationally and internationally. However, students with disabilities face several challenges in accessing e-content due to significant functional limitations and mismatch between user needs and resource availability in the e-learning environment. In order to promote true e-inclusion, it is necessary to understand and adhere to the web accessibility standards and guidelines such as WCAG. The use of AT should also be promoted amongst Divyangjan to facilitate accommodation and thereby support normalized access to ICT devices, e-services and online learning opportunities for learning skills towards promoting empowerment and independent living.

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