Web Accessibility and eLearning in India

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Abstract: eLearning is learning utilizing electronic technologies to access educational curriculum outside of a traditional classroom. In most cases, it refers to a course, program or degree delivered completely online. The number of eLearning websites have increased manifold in recent years around the globe. In many countries laws have been laid out to make sure that these websites satisfy web accessibility rules and standards which would make these websites accessible to disabled students also. However, not all websites comply with the web accessibility norms. This paper analyses web accessibility of some eLearning and University websites from India. Accessibility evaluation tools are used in this research to reveal statistics of web accessibility compliance. Paper also discusses accessibility norms laid down by the Indian government. Basic result of this research suggests that many of the Indian eLearning and University web pages have greater room for improvement on web accessibility.

Keywords—eLearning, disabled students, accessibility, accessibility rules, accessibility evaluation tools.

1. Introduction

The World Wide Web (WWW) has become an essential part of the human lives in the 21st century. A wide array of simple and complex task can be availed and done via the web. These tasks includes daily chores like shopping, bill payment, etc to complex tasks like predicting the next day’s weather, solving huge mathematical algorithms, etc. Nowadays sectors like Banking, Education, Insurance, Health, etc make use of the web to provide their clients with a user friendly business experience. The basic and fundamental idea of the World Wide Web is to provide all its users access to web contents irrespective of physical disabilities. The World Wide Web caters to all users having any kind of physical disability or not.

The association of internet and WWW in education has increased greatly by the usage of eLearning methodologies. The usage of internet in learning provides hands on experience to students by providing dynamic content like animation, videos, etc rather than using obsolete static learning components like charts, graphs, etc. Students in rural and urban areas can both enjoy eLearning privileges alike without the need for proper infrastructure like schools, classrooms, etc. Authors in their research provide comparisons between traditional learning and eLearning facilities [1]. A computer with a proper internet connection would suffice the requirements for students to learn via the web. Hence these eLearning websites can also cater to students with physical disabilities like vision disability, hearing loss and deafness, mobility impairments. Websites needs to comply with certain web accessibility norms to be able to cater to these users with physical disability. The basis of web accessibility is as simple as to ensure that people with physical disabilities can access the website just like a normal user.

Developed and developing countries in the world have different laws that check for web accessibility in websites especially for eLearning. However, these laws don’t guarantee proper web accessibility compliance for websites. Hence, proper checking, analysis and research are to be done on the level of web accessibility compliance of eLearning websites.

Researches have been already carried out in some Asian countries to evaluate web accessibility compliance of websites in those countries [2]-[4]. There are research and studies on e-Government websites of different countries from other continents on web accessibility compliance [5]-[7]. But, as far as we know there is very little or no research or study on measuring web accessibility compliance of eLearning and University websites in India. Therefore this paper attempts to measure and analyze the web accessibility compliance on different Indian University websites and eLearning websites. The Indian government has laid down certain laws regarding web accessibility compliance which is also discussed in this study.

The eLearning websites used in this study are as follows:
1) http://nptel.ac.in/
2) http://deity.gov.in/
3) http://www.sakshat.ac.in/
4) http://aview.in/
5) http://cec.nic.in/

Indian university websites chosen for this study are as follows:
1) Mumbai University: http://mu.ac.in/portal/
2) Delhi University: http://du.ac.in/
3) Nagpur University: http://www.nagpuruniversity.org/
4) Kerala University: http://www.keralauniversity.ac.in/
5) Madras University: http://www.unom.ac.in/

Three web pages from each of these websites are being used for this study. These web pages are analyzed using web accessibility evaluation tools such as AChecker and WAVE. Both of these websites are web portals that checks for accessibility compliance of a particular web page.

2. Web Accessibility

Web accessibility means using incisive measures to create web contents by all users irrespective of the user having any disability or not. The Web is fundamentally designed to work for all people, whatever their hardware, software, language, culture, location, or physical or mental ability. When the Web meets this goal, it is accessible to people with a diverse range of hearing, movement, sight, and cognitive ability. [8] A website or web page is said to be accessible when all users have equal access to its information and functionality. Web accessibility ensures that people with disabilities can perceive, understand, navigate, interact and contribute to the web. Web accessibility also benefits people without disabilities. For example, a key principle of Web accessibility is designing Web sites and software that are flexible to meet different user needs, preferences, and situations. This flexibility also benefits people without disabilities in certain situations, such as people using a slow Internet connection, people with "temporary disabilities" such as a broken arm, and people with changing abilities due to aging [9].

The underlying objective of the web is to cater to all people, whatever their hardware, software, language, culture, location or physical or mental ability. Making the web accessible is crucial to make sure that this objective is achieved. Web developers play an important in making sure that the web accessibility is achieved. However, web software also play an important role in web accessibility. These software help developers to create websites and web pages that can be usable to people with disabilities. Guidelines and rules to create accessibility solutions for web developers and web software are provided by Web Accessibility Initiative (WAI), a project by the World Wide Web Consortium (W3C) [10]. WAI guidelines are considered the international standards for Web accessibility. WAI's coverage of web accessibility includes 'web content' (websites and web applications), authoring tools (such as content management systems (CMS) and blog software), browsers and other 'user agents', an W3C technical specifications.

The Web Accessibility Initiative published the Web Content Accessibility Guidelines (WCAG) version 1.0 on 5th May1999 [11]. These guidelines are intended for all web content developers, web developers and authoring tool developers. The goal of WCAG version 1.0 is to promote accessibility and explain how to make web content more accessible to a wide user group or audience. These guidelines provide a definitive standard to develop accessible websites and are followed by many countries in the world. On 11th December 2008, the WAI released the WCAG version 2.0 which succeeds WCAG 1.0 [12]. The WCAG 2.0 covers a wide range of recommendations for making web content more accessible. Web content can conform either to WCAG 1.0 or to WCAG 2.0 or both. However, W3C recommends new and updated contents use the WCAG 2.0. In October 2012 WCAG 2.0 was approved as an ISO/IEC 40500 International accessibility standard [13]. WCAG 1.0 and WCAG 2.0 guidelines are based on three levels of conformance (Level "A", Level "AA", Level "AAA"). These conformance guidelines are based on three priority levels:

1) Priority 1: A Web content developer must satisfy this checkpoint. Otherwise, one or more groups will find it impossible to access information in the document. Satisfying this checkpoint is a basic requirement for some groups to be able to use Web documents.

2) Priority 2: A Web content developer should satisfy this checkpoint. Otherwise, one or more groups will find it difficult to access information in the document. Satisfying this checkpoint will remove significant barriers to accessing Web documents.

3) Priority 3: A Web content developer may address this checkpoint. Otherwise, one or more groups will find it somewhat difficult to access information in the document. Satisfying this checkpoint will improve access to Web documents. The conformance levels are as follows:

1) Conformance Level "A": all Priority 1 checkpoints are satisfied.

2) Conformance Level "AA": all Priority 1 and 2 checkpoints are satisfied.
3) **Conformance Level "AAA":** all Priority 1, 2, and 3 checkpoints are satisfied.

3. **Web Accessibility in India**

The world as a whole has experienced over 550 percent growth in Internet usage in the last decade [14]. With the Internet becoming a more important part of society throughout the world, many countries are recognizing and acting upon the need to ensure access to the web for people with disabilities. Although every nation has its own approach to ensure web accessibility one fairly common approach throughout the world is for nations to support and adopt the Web Content Accessibility Guidelines (WCAG) 2.0. Many countries both developing and developed have introduced policies regarding web accessibility [15].

India has an estimated 70 million disabled persons who are unable to read printed materials due to some form of physical, sensory, cognitive or other disability. The Indian government in its accessibility report states that it follows the priority 1 (level A) of the Web Content Accessibility Guidelines (WCAG) 2.0 [16] for the national portal www.india.gov.in. The Indian government has set up “Guidelines for Indian websites” [17] a website which assists in developing accessible websites which can conform to the guidelines provided by the Indian government. Some Indian states have also introduced policies/acts/rules related to accessibility under the Right to Information Act [18].

4. **Web Accessibility Evaluation Tools**

Web accessibility evaluation tools are software programs or web services that enable web developers and testers to check whether a particular website meets accessibility guidelines. There are numerous free online services where web accessibility can be evaluated. Some of the most well known web accessibility evaluators are AChecker, A-Prompt, Cynthia Says, EvalAccess 2.0, eXaminator, TAW 1.0 and 2.0, Total Validator, and WAVE 4.0.[19] These evaluators are popular because of their simplicity and ease of use. In this study we are using two well known evaluators in AChecker and WAVE 4.0.

4.1 **AChecker**

AChecker is used to evaluate HTML content for accessibility problems by entering the location of a web page, uploading an html file, or by pasting the complete HTML source code from a Web page [20]. AChecker produces a report of all accessibility problems for your selected guidelines. AChecker identifies 3 types of problems:

4.1.1 **Known problems:** These are problems that have been identified with certainty as accessibility barriers. You must modify your page to fix these problems.

4.1.2 **Likely problems:** These are problems that have been identified as probable barriers, but require a human to make a decision. You will likely need to modify your page to fix these problems.

4.1.3 **Potential problems:** These are problems that AChecker cannot identify, that require a human decision. You may have to modify your page for these problems, but in many cases you will just need to confirm that the problem described is not present.

4.2 **WAVE 4.0**

WAVE is developed and made available as a free community service by WebAim. Originally launched in 2001, WAVE has been used to evaluate the accessibility of web pages [21].

Although automated tools are very useful in web accessibility evaluation, these tools cannot be foolproof as there are some underlying issues which is neglected or cannot be checked with these tools. One of the main issues is human judgment. Without proper human touch and analysis a website can’t be accessible as human interpretation is crucial in web accessibility. Another issue is literal interpretation of guidelines. Any automated accessibility tool, being a piece of software, doesn't have very much in the way of common sense. It will interpret each and every accessibility guideline literally, without bearing any other thought to what else is on the page. Hence human guidance is crucial in web accessibility evaluation and cannot be neglected.

5. **Methodology**

In this study a web page from five Indian eLearning websites and five popular Indian University websites are evaluated with tow popular web accessibility evaluators.

<table>
<thead>
<tr>
<th>Table I: Websites Analyzed</th>
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<tbody>
<tr>
<td><strong>eLearning web pages</strong></td>
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<tr>
<td>NPTEL</td>
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<tr>
<td>DeitY</td>
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<tr>
<td>Sakshat</td>
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<tr>
<td>A-VIEW</td>
</tr>
<tr>
<td>Consortium for Educational Communication</td>
</tr>
<tr>
<td><strong>University Web pages</strong></td>
</tr>
<tr>
<td>University Of Mumbai</td>
</tr>
</tbody>
</table>
WAVE is another evaluator used in this study to analyze accessibility of certain web pages. WAVE is used to check web pages for accessibility errors, features and the usage of HTML 5 and ARIA tag. When a certain website URL is fed into the WAVE engine, it gives a detailed report of the various errors found in the web page. It also provides the number of accessibility features in that web page which is unique to WAVE because AChecker doesn’t provide this information. WAVE also gives the count of HTML 5 and ARIA tags used. HTML 5 and ARIA tags are used widely to make a web page accessible with the usage of screen readers.

6.2 WAVE results

Table II lists the various web pages and their names used in the study. eLearning websites chosen are government eLearning websites that are particularly newer and updated to latest technologies. The Universities chosen for this study are some of the prominent universities in India which are from four Indian states. The official websites of these Universities are also somewhat updated and conforms to newer technologies. Home pages of the above mentioned websites are used in the study as it one of the most visited page of any website. University websites are particularly used in this study because nowadays these websites play an important role for students in admissions, exams result, contacting University staff and viewing other static data like timetables, exam dates, etc. eLearning websites are in single digits while those of the number of errors found, number of features and the usage of HTML 5 and ARIA tag. When a certain website URL is fed into the WAVE engine, it gives a detailed report of the various errors found in the web page. It also provides the number of accessibility features in that web page which is unique to WAVE because AChecker doesn’t provide this information. WAVE also gives the count of HTML 5 and ARIA tags used. HTML 5 and ARIA tags are used widely to make a web page accessible with the usage of screen readers.

6.1 AChecker results

AChecker evaluates a web page for web accessibility compliance mainly against three types of problems viz. known problems, likely problems and potential problems. AChecker also provides a number of international guidelines based on which it will check that particular web page. For this study we have used WCAG 2.0 as the base guideline. Another important feature of AChecker is to validate HTML and CSS of the web page. AChecker also provides an option to export the evaluation report to a portable document file (.pdf) format for future use and analysis.

Figure 1 shows the results of our analysis based on the AChecker evaluation tool. The number of problems in each category in which the analysis is carried is given in the figure. eLearning section is given in an orange shade of color while University website section is given in a violet shade. The number of likely problems for each of the ten websites is high. eLearning websites fares well as compared to University websites in the AChecker analysis. Known and likely problems are less in eLearning websites which gives us an idea that eLearning websites are comparatively more accessible. Two eLearning websites scores a zero in likely and known problem sections. The number of problems in these sections for University web pages runs into double figures. Hence the AChecker result gives us an overview of the potential problems for the websites used in this study.

### Table II: Accessibility Evaluation Tools Used

<table>
<thead>
<tr>
<th>Evaluation Tools</th>
<th>Corresponding URL</th>
</tr>
</thead>
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<tr>
<td>AChecker</td>
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</tr>
<tr>
<td>WAVE</td>
<td><a href="http://wave.webaim.org/">http://wave.webaim.org/</a></td>
</tr>
</tbody>
</table>

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Table II lists the Accessibility evaluators used in this study are AChecker and WAVE. Web page links are fed to these evaluators and results are given on the basis of WCAG 2.0 guidelines. The evaluations and checking are done on a single day to avoid content change.

6. Results

6.1 AChecker results

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extensively to make a website accessible and hence its less or no usage shows the websites preparedness to handle web accessibility barriers.

<table>
<thead>
<tr>
<th>Website Name</th>
<th>Web page URL</th>
<th>Known Problems</th>
<th>Likely Problems</th>
<th>Potential Problems</th>
</tr>
</thead>
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<td></td>
</tr>
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<td>NPTEL</td>
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<td>34</td>
<td>3</td>
<td>341</td>
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<tr>
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<td>8</td>
<td>1</td>
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<tr>
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<td>0</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
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<tr>
<td><strong>University Websites</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Of Mumbai</td>
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<td>17</td>
<td>1</td>
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</tr>
<tr>
<td>Rashtrasaat Tukadoji Maharaj Nagpur University</td>
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<tr>
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<tr>
<td>University Of Madras</td>
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<td>University Of Kerala</td>
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<td>68</td>
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<td>489</td>
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</tbody>
</table>

Fig. 1 AChecker Results

Fig. 2 WAVE Results

7. Conclusion

In view of our study conducted on five Indian eLearning and five University websites by two web accessibility evaluation tools we can conclude that these websites have a long way to achieve web accessibility. Although the newer websites are somewhat good in terms of web accessibility, they also have quite some room for improvement. Our study suggests that Indian eLearning websites are ahead of the University web pages when web accessibility is concerned, by a very small margin. Indian University web pages need to be properly updated with newer features like HTML 5 and ARIA. Although being completely accessible is a very difficult proposition, attempts can be made to come close to higher degrees of web accessibility. Usage of the web will increase manifold in the future particularly in the education sector, hence websites that complies with the web accessibility guidelines will only help in the development of the country’s education sector especially in a developing country like India.

8. Limitations and Future work

A website is said to be accessible when a user irrespective of having physical disabilities or not can access it without any hindrance just like a normal user. The importance of web in the education has grown manifolds and even a student with some physical disability can log on to an eLearning website and gain knowledge just like a normal student. eLearning is said to the future in the education of the world. Hence it is very necessary to make an eLearning website accessible to all users. Web accessibility guidelines when followed correctly can reduce the effects of accessibility barriers from web content. In this study Indian eLearning websites are analyzed in a bid to understand whether these are accessible or not. In view of our results many prominent Indian eLearning websites don’t meet the
web accessibility standards. There is huge room for improvement and great amount of work can be done to make these websites accessible to all users. Automated web accessibility evaluators were used in this study and hence the limitations of these tools’ mirror this study too. One of the prominent limitations is that this study lacks a superior human judgment. Web accessibility is for human users hence only the usage of automated tools won’t suffice the study. Although web accessibility evaluators can conform to the guidelines provided by W3C, it cannot replace a proper experienced human evaluator’s judgment. Automated tools provide conformance to accessibility tests but this study cannot give a correct and precise judgment into the matter because accessibility tools provide a wide range of accessibility errors some of which may be applicable to a particular scenario and some maybe not. In our study we have used two different evaluators which provide the results in two different formats. Hence the results of these two evaluators are hard to compare and the level of errors to be accounted is also not possible. In our study we have used five eLearning and five University’s home pages, the results of these ten web pages are also difficult to compare and to find out the most accessible web page and the least accessible web page. Another of the limitation of this study is that we have used only ten web pages of ten different web sites. To provide a proper conclusion as to whether a particular website is accessible or not we need to check multiple web pages from the website. Our future work prospects are based on this limitation. Therefore, we plan to base our future study and research in checking more number of web pages and web sites. Another of our future work is to use multiple web accessibility evaluators as well to provide an insight from a higher level of conformance. Another future work prospect is to also use an experienced human judgment in the research. Finally, another future work is to compare eLearning websites of other developed countries like the US and UK with India.

9. Acknowledgements

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10. References


