Comparison of Web Accessibility in Technological Open-Access Journals from Latin America

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Abstract

Open-access journals (OAJs) collect preserve and publish scientific information, on digital form, related to a particular subject. Different kinds of topics are researched and published among them technological subjects. The access to the technological studies is important to the people with disabilities to find studies related to their needs and work.

The Web is used to disseminate the information on websites from OAJs. However, the Web non accessible is often a barrier to access the information by some groups of users with disabilities limiting their opportunities in education. To support the accessibility of web sites, different accessibility guidelines and standards have been introduced. Unfortunately, web developers often lack sufficient knowledge to meet these guidelines. To assure and certify the fulfillment of web accessibility guidelines, various automatic accessibility evaluation tools have been developed. In this paper, a comparative study of the web accessibility of official websites from 125 Technological Open-Access journals (TOAJ) from Latin American countries is presented. Two automatic evaluation tools have been used to perform the comparison: *TAW and eXaminator. The results show that most of the websites are not developed according to the web accessibility standards for persons with disabilities. Besides, we have developed recommendations for improving the accessibility of these websites for people with disabilities.*

1. Introduction

Open-Access (OA) is the free unrestricted online access to digital content. The Open-Access movement began in the 1990s [1], at the same time the World Wide Web became widely available and Open-Access Journals (OAJ) began to be developed. OAJs are journals available online "without financial, legal or technical barriers other than those inseparable from gaining access to the internet itself" [2]. However, many OAJs users may find problems if the websites do not achieve an adequate level of web accessibility. Therefore, web accessibility is increasingly critical to the OAJs to provide equal access to people with different disabilities (visual, hearing, cognitive, mental, and physical impairments) representing a huge challenge for web designers, web developers and content developers. A definition of web accessibility is "the property of a site to support the same level of effectiveness for people with disabilities as it does for people without disabilities"[3].

The Convention on the Rights of Persons with Disabilities [4], was signed on 2007 and ratified by several countries. It reaffirms that all persons with all types of disabilities must enjoy all human rights and fundamental freedoms. The article 24 of the cited Convention recognize the right of persons with disabilities to education without discrimination and on the basis of equal opportunity.

Unfortunately, few studies to measure the level of compliance of OAJs with accessibility guidelines have been done among the Latin American countries. In addition, the study of website conformance to WCAG is not enough because we need to consider also the conformance to accessibility guidelines of development tools and browsers [5].

The aim of this study is to compare the level of compliance of accessibility guidelines by the TOAJs websites. Two automatic evaluation tools TAW, and eXaminator.have been used to test the accessibility.

The remainder of this paper is structured as follows. Section 2 presents the background on web content accessibility guidelines and testing tools. Section 3 presents the methodology used in the study. Section 4 shows the results. Finally, Section 5 describes the conclusions, discussion and sketches future works.

2. Web Content Accessibility Guidelines and Testing Tools

Web Content Accessibility Guidelines WCAG 1.0 were developed in 1999 by Web Accessibility Initiative (WAI) from the W3C (World Wide Web Consortium). In 2008, a second version of the

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guidelines WCAG 2.0 [6] were published using testable statements, that are not technology specific, as success criteria to define conformance to the guides. WCAG 2.0 is organized in 12 guidelines under the following principles:

1. Perceivable: Information and user interface components must be presentable to users in ways they can perceived by the mind or sens.
2. Operable: User interface components and navigation must be operable by the users.
3. Understandable: The information and the operation of user interface must be understandable.
4. Robust: Content must be robust enough that it can be interpreted by a wide variety of user agents, including assistive technologies.

For each guideline, there are testable success criteria at three levels of conformance (A, AA, AAA), based on the checkpoint's impact on accessibility:
The analysis of websites accessibility is shortened using automatic evaluation tools such as Accessibility Valet, AChecker, A-Prompt, Cynthia Says, EvalAccess, eXaminator, TAW, and WAVE. Automatic tools generally verify the presence of a valid element or attribute, however, human judgment is also needed to verify the results.

3. Methodology

In this study, 125 TOAJs from Latin America countries have been analyzed and compared. The journals have been taken from the Directory of Open-Access Journals (DOAJ) in the technological category. DOAJ is an online directory that indexes and provides access to high quality, Open-Access, peer- reviewed journals. The analyzed OAJs procede from Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Mexico, Uruguay, Venezuela. Fig. 1, shows the number and distribution of the TOAJs analyzed extracted from DOAJ for each Latin American country. The data were collected in March 2016.
Two automatic evaluation tools have been used in this study. First tool is eXaminator, a free online service to check the accessibility of a web page [7]. eXaminator checks the application of the WCAG 2.0 on the HTML and CSS contents in a webpage and summarizes the results in an overall score from 1 to 10 the higher value correspond to a better accessibility. The score calculated by eXaminator does not cover all of the success criteria in WCAG 2.0. The second tool is the TAW, a free service developed by the Foundation CTIC [8]. This validator marks the accessibility violations to WCAG 1.0 and 2.0 and provides recommendations on how to solve them. This tool also reports the number of errors of each kind of accessibility principles of WCAG guidelines: perceivable, operable, understandable, and robust.

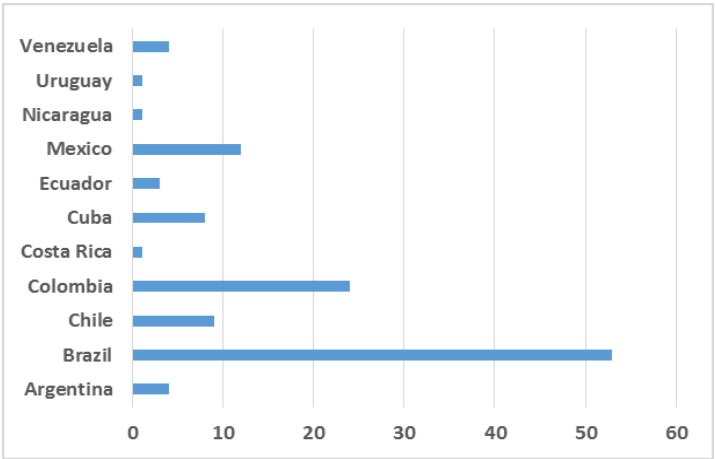

Fig.1. Number of TOAJs for each Latin American country registered in DOAJ.

4. Results and Discussion

Following we present the results of web accessibility analysis with each tool.

4.1 eXaminator

Using eXaminator software we collect score data from 125 technological Latin American journals from DOAJ. The statistics for the score are: mean=5.2, max=8, min=2.7, standard deviation=1.14. Figure 2

present the number of journals by eXaminator score: A large group of journals 82% has a score between 5 and 6. That means that a hard work should be made to motivate the journals to improve their websites in order to accomplish the WCAG 2.0 guidelines.

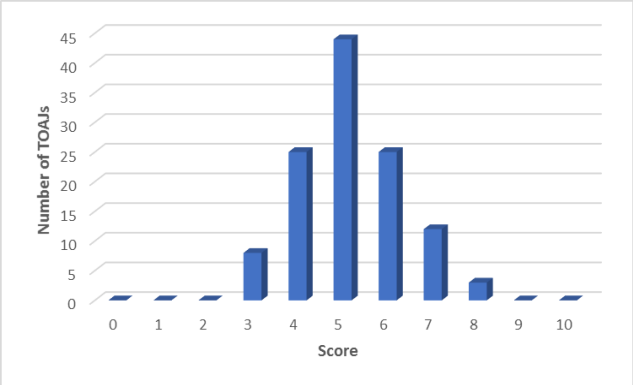

Fig. 2. Number of TOAJs by score

Table 1 shows the four TOAJs with better eXaminator scores from 7.5 to 8. The cited TOAJs websites should be improved to accomplish all the WCAG 2.0 guidelines.

Table 1. Four Better eXaminator Scores

Country	Journal	Score
Nicaragua	Nexo Revista Científica. http://www.lamjol.info/index.php/NEXO.	8
Colombia	Ingenierías USBMED. http://web.usbmed.edu.co/usbmed/fing/index.html.	7.8
Brazil	Alimentos e Nutrição. http://seer.fcfar.unesp.br/aen/index.php/aen.	7.5
Brazil	Informação & Tecnologia. http://periodicos.ufpb.br/ojs/index.php/itec	7.5

In table 2 we presented the TOAJs websites with the worst eXaminator score from 2.7 to 3.2. Those results show that few attentions were given to the WCAG 2.0 in the analyzed websites.

Table 2. Four Worst eXaminator Scores

Country	**Journal**	**Score**
Brazil	Journal of Urban and Environmental Engineering. http://www.journal-uee.org/	3.2
Brazil	DEMETRA: Alimentação, Nutrição & Saúde. http://www.demetra.uerj.br.	3.2
Brazil	Pesquisa & Desenvolvimento Engenharia de Produção http://www.revista-ped.unifei.edu.br./	3.1
Mexico	Journal of Applied Research and Technology. http://cibernetica.ccadet.unam.mx/jart/	2.7

4.2 TAW

Figure 3 shows the mean of accessibility errors in TOAJs by accessibility principles using TAW in the same journals cited in 3.1.

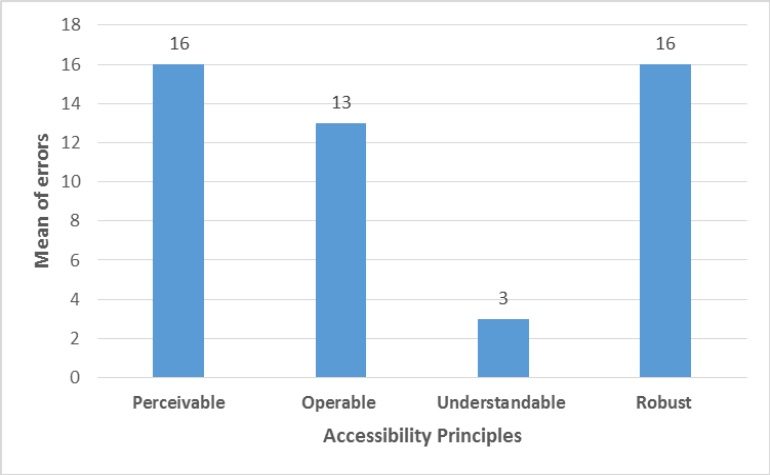

Fig. 3. Mean of errors by accessibility principles

The most common errors in the analyzed websites using TAW services are presented in table 4 for each principle of the WCAG 2.0 guide. To solve the problems it is recommended to use the techniques for WCAG success criteria [9]. Another guide is also given by Kuzma et al [10] including continuous monitoring and collaborative work.

Table 4. Most common errors in the analyzed websites

Perceivable	Operable	Understandable	Robust
Images that may require a long description	Use of device dependent event handlers	Form with no standard submission method	CSS validity check errors
Form controls without label	Links with same text but different target	Labeling of form controls.	Form controls without labels
Use of absolute units in block elements	None h1 element in the document	Does not provide assistance in the forms	Frames without title
Use of absolute font sizes	Inappropriate content of headers and labels	Does not provide suggestions for incorrect values.	Web page violates les rules of the language
Space interlines in text blocks	Empty links	Error prevention for all forms.	Does not use markup features to name and roles
Images with empty “alt” attribute	Not descriptive title	Declaration of language of the document	
Background and foreground colors in text blocks	Flashes below threshold	Words with unusual meanings	

5. Conclusions

Research in technological topics provides opportunities to overcome barriers (socio-economic, geographic, cultural, etc.) for people with disabilities. In this paper, a comparative study of the web accessibility of TOAJs websites from Latin America countries is presented. Two automatic evaluation tools have been used to perform the comparison: eXaminator and the TAW service. The used tools test the accessibility checking compliance of the websites with WCAG Guidelines. Automatic evaluation tools providing quick results are essential in analyzing a large number of pages. In this study, only the home page of each website has been analyzed. The mean score of the websites is low showing a lack of attention to WCAG 2.0 guidelines.

Developers, designers and content authors should work together assuring the accessibility of their work. Developers should take care of adequate navigation, links avoiding unexpected errors. Designer should take care of color contrast, size of title, alternatives to text images or video descriptions. An accessibility statement should be also prepared and included in the website.

Content authors should work in alternatives to images or videos where it is convenient, avoiding blank lines and considering all the accessibly guidelines. Finally, another future work is to detect the most common problems that recur in the same site and between different sites comparing the journals management software.

Finally, it is important to consider that websites conformance to WCAG is not enough because the tools used to develop the site have to be conformant to ATAG (Authoring Tools Accessibility Guidelines), and the browser used by the end user have to be conformant to UAAG (User Agent Accessibility Guidelines). The developer has not control of the developer tool nor the browser the user uses. In the future new studies should consider also this kind of conformance and usability studies with users.

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