

# Accessibility and Usability Evaluation of State-Owned Universities Website in Nigeria

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**ABSTRACT**----University websites provide an information space for services offered by the university as well as a platform for the ease of communication between the universities and their various stakeholders. The purpose of this research was to evaluate the accessibility and usability guidelines against Web Content Accessibility Guidelines (WCAG) 2.0 and US Federal (Usability.gov) guidelines. This study used SortSite Automated Tool to evaluate the conformance of 10 randomly selected websites of state-owned universities in Nigeria. The results revealed that the websites do not conform to the implementation of WCAG 2.0 and also most usability guidelines hinder the ease of access and navigation thus enhancing barriers to web accessibility. The study suggested recommendations that will improve the information space of the university websites in Nigeria.

**Keywords:** Academic, Accessibility, Usability, Website

## 1. INTRODUCTION

University websites play a very crucial role and act as interface between the university and diverse range of users as they enable the dissemination of information to the public. The primary purpose of academic websites is to enable prospective students learn about the institution, courses offered, syllabus of each course, requirements for admission, research groups and publications, career counselling services, disability services, library services, financial aids, employment opportunities, policies, news updates etcetera [1]. These services and many others have helped universities to reduce cost, improve service delivery and increase prospective student participation as well as improve decision making on what university and programme to apply for. With the list of services offered by these websites, the question of its usability and security is important [2]. The dream behind the web is to provide a common information space for communication and sharing of resources irrespective of disability or any other restrictions.

As the need for information dissemination and the quest to remain competitive and globally visible increases, most universities around the world now have dynamic websites [3]. With the widespread

adoption of this technology, not all design requirements have been implemented in order to enhance and improve the use of these websites implemented by all users. This trend is what led to the creation of the World Wide Web Consortium (w3c) with the goal of ensuring that the world-wide web is used to its full potential by developing protocols and guidelines for the long-term growth of the web [4].

In Nigeria, many academic websites have incorporated these design requirements to improve the accessibility and usability in accordance with international Standards. Usability of a website as defined in ISO 9241-11 is the extent to which it can be used by the specified users effectively, efficiently with optimal satisfaction [5]. Accessibility is the ability of everyone to have access to the web and its resources irrespective of challenges ranging from physical, neurological, speech to vision, auditory and cognitive impairments [6]. Accessibility therefore is a sub-set of usability. The usability of academic websites must meet the needs of both Able bodied and disable users thus increasing the quality of websites. Usability is an important feature that increases the quality of a website [7].

This research therefore is aimed at evaluating the accessibility and usability of state-owned university websites in Nigeria by randomly selecting 10 using SortSite Automated Tool.

## II. RELATED WORKS

Any application or website must have as one of its key concern the need to meet all accessibility and usability guidelines [8]. Tim Berners-Lee's, creator of the web's goal for the web was a common information space which will facilitate the ease of communication and information sharing. A number of studies on academic website accessibility and usability have been conducted as reviewed below not much in relation to the security of these websites.

Reference [9] studied 10 randomly selected academic websites in India using two automated tools Sit Analyzer and Qualidator. The tools were selected to analyse the content, design, performance, accessibility, Search Engine Optimization, Page Analysis Score as well as the

usability features and calculated the overall performance of the websites. The study showed that the comparative analysis of both tools ranked different universities best based on the results obtained. However the evaluation of both results showed that a few universities had to a great extent implemented the most important aspect of website design which includes Usability, Accessibility and Search Engine Optimization.

Reference [10] evaluated 36 Federal Universities in Nigeria using three automated tools namely Web Accessibility Checker (Achecker), HERA and WAVE. The results showed that the first two automated tools were set to check compliance against WCAG 2.0 accessibility criteria. Most of the websites did not comply with the standards as they reported obvious errors. The third automated tool (HERA) was further used to evaluate the sites to ensure they comply with the previous WCAG 1.0 standard. Based on their evaluation, the tools identified inherent errors and problems in the websites and ways for improvement were suggested.

Reference [11] studied a number of websites of Jordanian Universities using two automated tools namely HTML Toolbox and WebPageAnalyzer. The results of evaluation showed that the websites conformed to the usability standards and were accepted as suitable.

Reference [12] investigated the information of 55 government website of Kyrgyz Republic for accessibility, usability and security. The usability evaluation showed that usability requirements reported an error rate 46.3% while accessibility analysis reported a higher value of 69.38% error rate with vulnerabilities in the security of the websites.

### III. METHODOLOGY

Accessibility assessment can be evaluated at the end of the development process or while already in operation on site or as a continuous process from the initiation of the project throughout the lifecycle of the website. The earlier process known as the summative form of evaluation is conducted to check the conformance of an already existing website against the guidelines whereas the later known as the formative form of evaluation is conducted continuously during the development process. Both methods of evaluation can be conducted using automated tools alone or an integration of automated tools, human experts and end users. The goal however, is to ensure the quality assurance of the website [13].

#### A. Sampling of Academic Websites

This study randomly selected 10 universities websites that cuts across the different parts of the country. All universities were selected based on the fact that they are owned by their respective State Governments. As against Federal Universities,

researches of this nature have not been conducted on state-owned universities in Nigeria. Table 1 below shows list of selected universities.

**TABLE I**  
A sample of Universities websites selected for Evaluation

S/N	Names of Universities	URL of websites	Abbreviation
1.	Abia State University, Uturu	http://abiastateuniversity.edu.ng/	U1
2.	Benue State University, Makurdi	https://bsum.edu.ng/	U2
3.	Cross River State University of Technology, Calabar	https://crutech.edu.ng/	U3
4.	Delta State University, Abraka	http://www.delsu.edu.ng/	U4
5.	Ebonyi State University, Abakaliki	http://ebsu-edu.net/	U5
6.	Kebbi State University of Science and Technology, Kebbi	http://www.ksusta.edu.ng/	U6
7.	Kwara State University, Ilorin	http://kwasu.edu.ng/	U7
8.	Lagos State University, Ojo, Lagos	http://www.lasu.edu.ng/	U8
9.	Rivers State University, Port Harcourt	http://www.rsu.edu.ng/	U9
10.	Sokoto State University, Sokoto	http://www.ssu.edu.ng/	U10

#### B. Automated Evaluation Tools

SortSite evaluation tool was employed in this study to evaluate the conformance of the above websites to Web Content Accessibility Guidelines (WCAG) 2.0 published by the Worldwide Web Consortium (W3C). An evaluation tool is an automated tool that examines the source code of web pages to determine if it conforms to some guidelines [14]. These automated tools are either free online services (eg. AChecker, TotalValidator, TAW, Deque etcetera) mainly obtained online or require commercial licenses (SortSite, AMP etcetera) that is provide a desktop deployment environment for evaluation. Some tools are designed to exclusively focus on web accessibility, other provide additional test for usability and quality assurance [15]. The evaluation analysis of automated tools is diverse. Some reports are presented in the form of web reports, XML files, Microsoft Excel and word files and emails. However, there is no universal agreement on which tool is more suitable in evaluating accessibility and usability of websites [16] hence adoption of any automated tool is based on the scope and need of the research.

**IV. Evaluation Procedure**

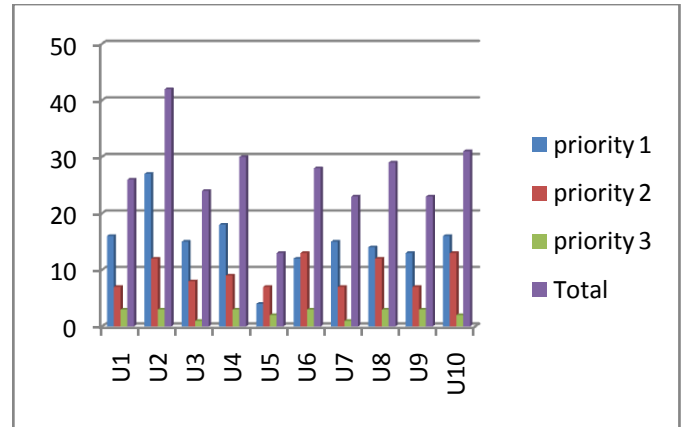
**C. Accessibility Analysis**

The WCAG was introduced by the W3C as a set of guidelines that website developers, authoring tools, evaluation tools and others who need or want standards for Web Accessibility (WA) can implement in order to achieve accessibility for a wider range of users [17]. These guidelines are grouped based on their priority levels into three (3) as shown in table 2 below:

Priority	Level	Description
Priority 1	A	A web content developer must satisfy this checkpoint. Satisfying this checkpoint is a basis requirement for some groups to be able to use web documents
Priority 2	AA	A web content developer should satisfy this checkpoint. Satisfying this checkpoint will remove significant barriers to accessing web documents
Priority 3	AAA	A web content developer may address this checkpoint. Satisfying this checkpoint will improve access to web documents.

**Table 2: WCAG Priority Levels**

A total of 10 websites were scanned using the SortSite to test for accessibility and usability issues. For each university's website, a maximum of 100 pages were scanned and the results of issues identified under the three priority levels were recorded.



**Fig 1: Total Accessibility Issues per priority per website**

The evaluation showed that the 10 websites analysed had average accessibility issues per Priority I (15 issues), Priority II (9 issues) and Priority III (2 issues) respectively. However, conformance to the inclusion of priority III guidelines reported lower results against priority level I. However, U2 website reported the highest number of Priority I issues next to U4 with U5 reporting the lowest level of reported issues on all Priority levels as shown in Fig 1.

Though the websites were evaluated for conformance to WCAG 2.0, most websites reported issues or violations of WCAG 1.0. The result of evaluation showed that some accessibility guidelines were not implemented as expected hence WCAG 2.0 F24 which relates to failure of specifying foreground colours without background colours. Some accessibility issues reports failure to checkpoints 1.4.3 and 1.4.6 (WCAG 2.0 F83) which requires providing sufficient contrasts with foreground text (or images of text) with 106 occurrence.

Issues of violation with high occurrence of 320 includes WCAG A F89; this failure occurs when a link contains only non-text content such as an image and hence cannot be identified by an accessible name. Electronic forms designed should allow for people using assistive technologies to have access to the information, field element and functionality required with ease of completion and submission. This requirement as stated in Section 508 1194.22 (n) was mostly violated by all websites with an occurrence of 249.

Other randomly selected list of issues and their occurrences are as stated in table 3 below:

Prior ity Level	Issues/Checkpo int	No. of occur rence	Description of checkpoint
A	WCAG 2.0 A F30	33	Provide text alternatives for any non-text content
A	WCAG 2.0 A F68 Section 508 1194.22 (n)	274	User interface control not having a programmable determined name
A	WCAG 2.0 A F70	37	Incorrect use of start and end tags or attributes made up causing screen readers to miss content
A	Section 508 1194.22 (m)	58	This page has links to a PDF file, but does not provide a link to download Acrobat Reader
A	WCAG 2.0 A F25	30	When the web page has a title but the title doesn't identify the contents or purpose of the page
A	WCAG 2.0 A 2.4.1 Section 508 (2000) 1194.22(i)	39	No TITLE attribute found for frames on these pages.
A	WCAG 2.0 A F7 Section 508 (2017) A F7	30	Avoid animated images over 5 seconds long that can't be paused or stopped.
A	WCAG 2.0 A 3.1.1 Section 508 (2017) A 3.1.1	59	Use the LANG attribute to identify the language of the page.
AA	WCAG 2.0 AA 1.4.4 Section 508 (2017) A 1.4.4	165	Use relative rather than absolute units in CSS property values.
AA	WCAG 2.0 AA F78	4	This css property makes it difficult or impossible to see the dotted link focus outline.
AAA	WCAG 2.0 AAA F78	199	Many people with cognitive disability (including dyslexia) find justified text style hard to read (text align to both left and right margin)
AAA	WCAG 2.0 AAA F84	4	Link uses general text like "Click Here" which does not explain link purpose.

**Table 3: Summary description of violated checkpoints**

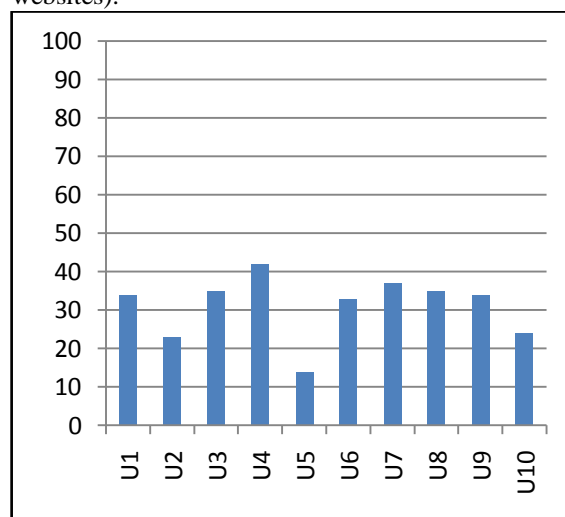
The study also showed that 90% (9) of the websites can be accessed on mobile phone browsers and compactible with iOS, Android and Blackberry Operating Systems.

**D. Usability Analysis**

In this study, usability analysis measured general issues including navigation problems for all users. The quality of a website therefore is defined by ease to content, accessibility, layout and navigation. A maximum of 100 pages of each website was scanned to check for violations in the design and implementation of usability guidelines using the SortSite tool.

The total number of occurrence of usability issues per website varied with U5 reporting the

lowest level of violations as against U2 and U4 with 478 and 473 issues respectively. The total number of pages that reported usability issues per website was approximately 67.9% (6 out of 10 websites) while the average number of usability issues per website that reported less than 210 violations was 87% (8 out of 10 websites).



**Figure 2: Total Number of Pages with Usability Issues**

The study also found many violated in the implementation of Usability.gov 14:3 based on the total number of occurrence. Large images usually slows the download speed of web pages which should not exceed 5 seconds. Users usually find slow download speeds of websites very frustrating. Also omitting IMG WIDTH and HEIGHT attributes means page text jumps about as Image loads which also reduces the speed of download.

Similarly, Usability.gov10:1 guideline was also violated by most websites scanned. This guideline provides that link labels and concepts be meaningful, understandable and easily differentiated therefore the links should be able to say something about its destination. The study also found that Usability.gov 9:2 was also violated with a high number of occurrences reported. The creation of a descriptive, unique and concise title for each webpage should be further implemented. Titles are used by search engines to identify pages hence their description should be unique. Reviewing the results of the scanned websites also showed that Usability.gov 7:3, 5:6, 13:12, 10:7 and 12:9 had the lowest occurrences reporting 1,1,2,4 and 2 respectively.

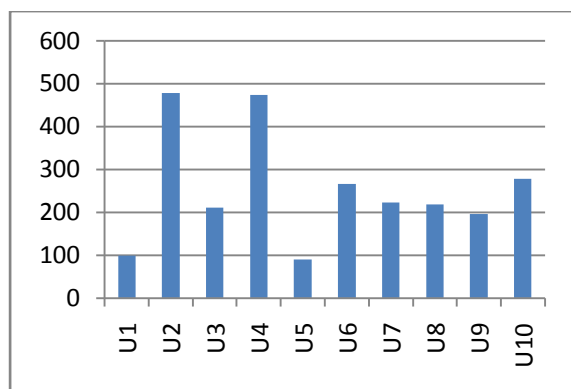


Figure 3: Total Number of occurrence of Usability Issues per website

Issues/Checkpoint	No. of Occurrence	Description of checkpoint
Usability.gov 10:1	38	Users should be able to quickly look at and tell where it goes.
Usability.gov 13:2	22	Ensure a push button's label clearly indicates its action.
Usability.gov 10:4	17	Avoid underlined text-people will click on it and think it's a broken link.
Usability.gov 14:3	262	Omitting IMG WIDTH and HEIGHT attributes means page text jumps about as images load.
Usability.gov 7:3	1	On long pages, provide a list of contents with links that take users to the corresponding content farther down the page.
Usability.gov 10:11	14	Use link text between 3 and 100 characters so it's long enough to be understood but avoid line wrapping.
Usability.gov 11:10	27	Use italic text sparingly for one or two words or a short phrase.
Usability.gov 9:2	235	The page title is not unique. Each page should have a description and meaningful different title.
Usability.gov 5:6	1	An active "Home" link on the home page makes some users think it's not the home page.
Usability.gov 12:9	2	Capitalize the first letter of the first word in a list.
Usability.gov 13:9	4	Radio buttons are easier to use than drop-downs when there are 6 choices or fewer.

Table 4 shows a list of randomly selected description of violated Usability checkpoints.

The usability analysis also included the tests for broken links. Broken links are links that send visitors to pages that no longer exist. For this test, 70% (7 out of 10 websites) reported broken links of less than 10 while 30% reported broken links of more than 10. The total number of broken links reported was 77.

## V. DISCUSSIONS

In this study, universities websites have been evaluated using an online automated tools; SortSite to conduct evaluation of Accessibility, Usability to test conformance against W3 Web Content Accessibility Guidelines (WCAG) 2.0 and US Federal (Usability.gov) guidelines. Universities websites serve as an interface between the university community and the general public. With its aim of providing prospective students with information and services offered by the university.

Overall, usability evaluation of the websites found low priority implementation as 87% of the websites reported violations of more than 210 although only 30% of the websites reported broken links of more than 10 which implies that the websites have fewer broken links which should either be removed or updated.

Though the websites were evaluated for conformance to WCAG 2.0, most of the websites reported issues of non-conformance to WCAG 1.0. The accessibility test also showed that 60% of the websites reported less than 10 violations of conformance to Level AA guidelines while 1% reported less than 10 violations of conformance to Level A guidelines. These results suggest that guidelines such as WCAG 1.0 be further reviewed in the update of the design of the websites. A detailed analysis of the evaluation for web accessibility showed that of the 100 pages scanned for each website, a total of 8 websites had violation occurrences of more than 200.

The findings also reveal that the ease of use as a design principle of usability should be implemented continuously by the developers of academic websites. This principle further provides for the effectiveness, efficiency and satisfaction of the wide range of users of the websites.

From the analysis of the websites, the Universities web development team needs to re-evaluate the content as well as ease of navigation of the environment of their websites to ensure conformance to WCAG 2.0 priority level AA as this is the new standard. Also the various accessibility and usability needs of the different classes of users should also be put into consideration [18]. Thus, the environment and content of the websites should provide for "alternativeformats" that would benefit the different classes of users. WCAG 2.0 A F30 requires the provision of text alternatives for any non-text content.

## VI. CONCLUSION AND RECOMMENDATION

The evaluation of this study was conducted using automated testing tool i.e. Sortsite. This tool provides evaluation of website against WCAG 2.0 as well as Usability.gov guidelines. Despite the results obtained from the study, some limitations were encountered. The content of most web pages were not available as some broken links were reported during the evaluation test period thus limiting the results obtained.

The web as an information space should be accessible and usable by all users [19] [20] hence further study be conducted to review the accessibility and usability of e-learning websites for the visually impaired and other users challenged with one impairment or the other.

Subsequent studies in evaluating academic websites should include a combination of Expert, End User and automated tools analysis. This will provide for the better evaluation of findings and further improve the quality of access to the information and services provided by the websites.

The security of the websites is an important aspect of website evaluation that should be studied to test the security vulnerabilities of the websites such as cross-site scripting, password attacks and SQL Injection.

The universities should ensure that they adhere strictly to international accessibility and usability standards thus enforcing the implementation of these standards by the web development team. Also periodic review of the websites should be conducted as a maintenance best practice for improving the content of the websites.

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